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URIC ACID IN GOUT.[1]

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Introduction. Up to the present time the only chemical problem considered in gout has been that of uric acid. As yet no other chemical standpoint has been found. Are we on the right track in doing this? Is uric acid really the principal toxic agent in gout, or only one of many? From time to time, especially when there appeared to be no progress in the investigation of the subject, protests arose that research was on the wrong path.

The relations between uric acid and the occurrences in gout become evident in the acute periods. The attacks are certainly connected in some way (yet to be determined) with the accumulation of this substance in the body, and during the attacks the

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output of uric acid is greatly altered. Experiments made with uric-acid injections prove their toxic character; the inflammation and the pains provoked by them resemble in many respects those occurring in attacks of gout.

Though conceding this, von Noorden, a number of years ago, following Ebstein's theory of the formation of uric acid in the bones, expressed the opinion that the deposits of uric acid were quite independent of the general metabolism of uric acid. Although local influences play an impotant part in gout, this view of von Noorden is easily refuted. The microscope shows clearly that the crystals are first found near the free surface of the cartilage and that they advance slowly toward the deeper layers. Thus, they must pass from the cavity of the joints into the cartilage. Secondly, when a tophus on the finger reaches the size of a chestnut, and even larger, it is impossible to imagine that the enormous masses of sodium urate stored up here could be formed in loco, even in the course of many years. The metabolism of connective tissue is much too torpid, and nuclear material, known to be the sole source of uric acid, is contained in only small amounts in the cuticle and neighboring tissues. Moreover, whenever one finds deposits of sodium urate in the body, that is, whenever gout is apparent, there at the same time an excess of this substance occurs in the blood. Although this principle is not reversible, it proves certain connections between the local and the circulating uric acid.

Preliminary Notes. In reference to uric acid, gentlemen, please remember that in reality we have to deal only with monosodium urate in the fluids within the body. Some authors have assumed the existence of a quadriurate of sodium, or, as we would call it now, of monosodium biurate or hemiurate; others have insisted that in a fluid containing a number of basic molecules like serum, the chemical union of an acid with one of the bases could not be recognized. Physically considered, there exists no monosodium urate in the serum, no more than monosodium carbonate. All these salts are dissociated into their ions, and we have to deal only with sodium, potassium, calcium ions and with uric, chloric, carbonic acid ions, existing side by side. But with the same right with which one speaks in the common language of chemistry of the existence of sodium chloride, of monosodium carbonate, and monosodium phosphate in the serum, with just as much right one may also speak of monosodium urate. Ninety per cent. of the kations in the serum belong to the sodium, only 10 per cent. to potassium, calcium, and so on. In a neutral solution which, in a physicochemical sense, the serum is, the proportion between kations and anions, or between acids and bases, is such that we can only speak of monosodium carbonate and of monosodium urate. The existence of bisodium urate is just as impossible here as the existence

of bisodium carbonate. It is to Gudzent that we owe the clear exposition of this.

FUNDAMENTAL PRINCIPLES. As compared with former times, we now stand on a firm foundation in regard to our knowledge of the formation of uric acid. This substance is derived from the nuclear purins, adenin, guanin, hypoxanthin, and xanthin. Their transformation into uric acid is the work of hydrolytic, of desamidizing and oxidyzing ferments. The ferment which katabolizes uric acid is called the uricolytic ferment. I need not detail these processes, but will refer you to Prof. Mendel's lecture delivered on this subject three years ago before this Harvey Society.

This being established, two questions arise:

1. Whether this intermediate path of metabolism is obligatory in the sense that every molecule of the purin bases must reach the stage of uric acid, or whether adenin or hypoxanthin, and so on can be katabolized without first being converted into uric acid. Thus far the possibility of the latter proposition has never been demonstrated in the organism. Chemical considerations and biological analogies lead us to consider the transformation of purin bases into uric acid as the only process effective in mammals.

2. The second question, whether in mammals there are still other sources of uric acid, is doubtful. No proofs have yet been brought forward of a formation of uric acid from urea and from acids with three-carbon atoms, a process which is of fundamental importance in birds. So we may neglect this kind of synthesis. On the other hand, it is beyond question that purins are newly formed in suckling animals whose food is practically purin-free. It seems improbable that the synthesis effected here starts from urea; we must rather look for a higher amino-acid compound, as a material which can yield purins. It would be very surprising if this synthesis were performed on a larger scale than was needed for the growth and for the renewal of the tissues, that is, for the synthesis of nucleoprotein. I do not think that in this process an excessive formation of purins takes place, or that superfluous material for the formation of uric acid is left over. We may with our present knowledge consider the purins as the only source of uric acid in human metabolism.

We distinguish the exogenous purins ingested with the food from the endogenous derived from the nucleins of the body. By dieting we can make ourselves independent of the great variations in the output of uric acid due to the different amounts of ingested purins. By giving a purin-free food, which need not be absolutely the same every day, the urine will contain endogenous uric acid only. The quantity eliminated, although varying in different men from 0.3 to 0.6 gram, is fairly constant in the same person under normal conditions, thus proving the existence of an equilibrium between the formation and the destruction of uric acid. The simplest conception of this is, not that formation and destruction vary always

in the same sense and proportion, but that both formation and oxidation are constant.

The katabolism of uric acid leads to the formation of allantoin in dogs and rabbits. In man its fate is unknown. In contrast with the results in most animals, human organs have failed to show a distinct uricolytic power. Hence Wiechowsky drew the conclusion that uric acid was indestructible in the human body. He based this opinion also on a second fact, namely, that uric acid injected into the muscles of men is found again almost quantitatively in the urine. Schittenhelm although confirming Wiechowsky's experiments with human *organs*, was able to show that uric acid undergoes destruction in *living* men. When a person, who was in nearly perfect nitrogen equilibrium, was fed with 10 grams of nucleic acid, the output of purin substances was only slightly increased, and instead, an increase of urea (or a substance behaving similarly) was found, and in amount corresponding nearly to that of the nitrogen of the ingested purin compounds. It would be of greatest interest for physiological chemistry to determine what are the intermediate and end-products of the uric acid breakdown; but for the knowledge of gout, this is of less importance. It suffices for the present to know that this toxic substance disappears as such.

If Wiechowsky's opinion were right it would mean a simplification of experiments and of theory, for one unknown component in the complex equation of urate metabolism, the destruction of uric acid, would be eliminated. Recapitulating, one may say that the present foundation for investigations of the metabolism in gout is as follows: We have to deal only with *one* source of uric acid, namely, the purins; and, after excluding the exogenous purins, we find a uniform elimination at certain periods. This we accept as a firm basis for comparison, both as regards the metabolism of healthy men and also with regard to the variations which occur in different periods of gout.

THE FACTS IN GOUT. What are the facts in gout which are established with such accuracy that we can take them as a basis for our consideration? What results are sufficiently probable to be taken into serious discussion? The facts and the probable truths are as follows:

1. The presence of uric acid in the blood.
2. The presence of crystalline deposits.
3. The increased output of uric acid in the attacks of gout. The augmentation can reach from 0.3 to 0.5 gram daily and more, and may sometimes last for a week or even two.
4. A decline in the output of uric acid often precedes the attack of gout, but this diminution is not as marked as the subsequent increase, and its duration is only one or two days.
5. In the intervals between the attacks of gout the elimination of endogenous uric acid is asserted to be lower than in health.

There are doubts whether this statement has been proved beyond question.

6. The elimination of exogenous uric acid is often retarded.

To elucidate the connections between these data it would be necessary to have a complete knowledge on the quantitative side of the following processes in both health and disease:

1. Of the formation of uric acid.
2. Of its destruction.
3. Of its elimination by the kidneys.

From a combination of these three processes would arise a knowledge—

4. Of the accumulation of urates in the body, especially in the blood.

5. We ought to know the conditions of the sodium urate precipitation in the tissues, as well as the conditions for its removal. Herein is included a knowledge of the physical and chemical behavior of sodium urate.

THE FORMATION OF URIC ACID. Is the formation of uric acid increased or is it diminished in gout? In almost every case in which we see an increased output of uric acid, for example, in leukemia and pneumonia, we find an increased destruction of nuclear material, and vice versa. In gout, at least in the intervals and when the patient is given purin-free diet, neither one nor the other is to be observed. The katabolism of nuclear material therefore is certainly not increased.

On the other hand, we have just as little reason to assume a diminished formation. Brugsch and Schittenhelm, it is true, have recently advanced the theory that the total nuclear metabolism in gout is retarded. But even if this were true, I must insist that retardation of metabolism is not in every case identical with diminution. Perhaps in *advanced* stages of the disease, a decrease in the formation of nuclear compounds may take place, due to a kind of cachexia of premature aging. In the experiments made hitherto I miss a clear distinction and separation as to the age and the general state of health. Most of the gouty patients treated in hospitals are in an advanced stage of their illness, and evince signs of cachexia, even when showing a good volume of muscles and of subcutaneous fat. The healthy people, whose nuclein metabolism has been compared with that of the gouty, were generally younger. In order to obtain a more reliable material for the comparison between normal and gouty metabolism, stricter attention ought to be paid to this point regarding age. Bearing this criticism in mind, the following exposition may be considered. In any case it seems to be certain that, in opposition to former opinion, the occurrences in gout cannot be explained by excessive formation of uric acid. In the older days whenever an increased output of uric acid was noticed the cases were mostly those of wealthy people overfed

with meat. Gouty patients are generally hearty eaters. The high amount of uric acid in these people is due to the ingested purins, not to the diathesis. Analogy with obesity produced by polyphagy is striking. The gouty process, though no doubt aggravated by an excess of exogenous purins, does not depend on an increased uric-acid formation.

THE DESTRUCTION OF URIC ACID. In many experiments the twenty-four hour output of uric acid in the urine of gouty men is diminished. So far as this is not due to lessened formation, it proves an increase in the *absolute* quantity of uric acid destroyed. The accumulation in the body does not reach such an extent as to explain the difference of excretion between healthy and gouty men. This difference often reaches 100 mg. in 24 hours. Supposing this quantity were retained in the body day by day for one year only, the total sum would amount to 36 grams. Deposits of such enormous size are extremely rare, at least in Germany. I doubt whether in the majority of cases 10 grams of sodium urate may be extracted from the gouty body. Since the lower quantity of uric acid in the urine is not explained by an accumulation, it must be ascribed to increased destruction. As Brugsch and Schittenhelm rightly suggest, this does not mean absolutely that the oxidizing power of uricolytic ferment is greater than normally or that its quantity is increased. The reason may be that each molecule of uric acid circulates a longer time in the body; thus it is exposed more often to the influence of the oxidizing ferments, and thus there is more chance for its destruction. The investigation of the blood renders it probable that such prolonged circulation of urates really occurs in gout.

The conclusion that the *endogenous* uric acid is katabolized in greater amount is confirmed by the results of experiments in which the fate of *exogenous* purin was studied. In a great number of these observations the output of uric acid after feeding sweetbread, or other nuclein-containing material, was less than in healthy persons. It also is to be remarked here that more time is needed for the elimination of exogenous purins than normally, in spite of the fact that smaller quantities are excreted. Different gouty patients do not behave alike. There are some in whom destruction and elimination are performed in the same length of time and to the same extent as in healthy persons. It would be premature to assume a retardation of the purin metabolism as being the constant rule. I refer again to the above-mentioned objections concerning the influence of age and general state of health upon the purin metabolism.

THE EXCRETION OF URIC ACID. The excretion of uric acid by the kidneys depends, like that of any other substance, on two factors. The elimination can be diminished when the secretory power of the kidney is lessened; and it can be prevented also when the substance in question is united to another complex and thus bound.

In nephritis elimination of uric acid is markedly disturbed. Thus,

during favorable periods, even when no other substance is retained (in any amount worth mentioning), some milligrams of uric acid are always present in the blood of the nephritic patient. It seems to me as though the special capacity for the excretion of urates is more limited and can more easily become deficient, than any other function of this organ. I will try to explain this.

In administering an excess of any substance, the level of its end-products rises in the blood. This is due to the fact that the output by the kidney does not keep pace with the influx into the blood. But though with every other substance the level rises only by a small amount, with *uric acid* it may rise to ten times its normal height. While scarcely ½ milligram is contained in 100 c.c. of normal blood, Weintraud found 5 milligrams after feeding with an excess of sweetbreads.

I may now speak of the second factor, that is, the preventing of the elimination of a substance by its chemical combination with another. Such a theory has been offered in order to explain the non-excretion of sugar in the healthy organism. Minkowski tried to introduce this idea into the theory of gout. He assumed a chemical union of uric acid with a nucleic acid. But the search for such a compound in the blood has not been successful. Gudzent, on applying Michaelis' method of compensation to the dialysis of gouty blood, was able to show that the urates exist only in the free state. I might also mention Garrod's thread experiment as speaking against any organic union. Acetic acid, which sets free all uric acid in the serum, or at least the greatest part, is an extremely weak acid, its strength being some hundred times less than that of hydrochloric acid. Under the conditions of the thread experiment it would not suffice to split any organic union.

The hypothesis of Minkowski having been thus refuted, Gudzent showed another possibility. By physico-chemical methods he pointed out that the sodium urate exists in two modifications, which differ only in their solubility. He ascribes the existence of these two forms to a difference in the chemical structure, to a tautomerism. The lactam form, that is the substance having the formula which is generally used for the structure of uric acid, is the more soluble one, but tends to pass into the lactim form, which is less soluble. If the difference in solubility of the sodium urates is really due to a difference in the chemical structure, and not purely to physical reasons, one could imagine that the tautomeric forms would behave differently in regard to their excretion by the kidneys. Experiments in this direction have not been performed.

URIC ACID IN THE BLOOD. Normal blood is practically free from uric acid. In gout it can contain 5 to 10 mg. per 100 c.c. after a mixed diet has been taken; following a purin-free diet the amount is lower, being from 2 to 4 mg., but in no case is uric acid absent. Its presence in gout cannot be explained by an excessive pro-

duction of uric acid, as is the case in leukemia and in pneumonia. This conclusion, though it is contrary to the opinions of a former time, is beyond doubt.

It can be attributed chiefly or partly to a passive retention in those cases in which the kidneys are suffering, either from the beginning —what has been called kidney gout (Nierengicht)—or in later stages of the disease. On this point no controversy exists between the different authors. But how is the presence of uric acid to be explained in those cases in which the most accurate research does not reveal any sign of nephritis? The answer is only to be given conditionally.

If neither the formation of uric acid is increased, nor its destruction greatly diminished—and these two conditions seem to be realized in gout—if, moreover, the uric acid is not prevented by a chemical union or by an abnormal structure from passing into the urine, only one conclusion is possible. The retention is due to a deficient and restricted secretory power of the kidneys.

The existence of such a renal inadequacy does not mean a real nephritis. I think it possible that a single function of this organ can become almost exclusively insufficient. Later on, real damage to the kidney and a nephritis frequently follow.

As stated already by Garrod, uric acid is present also in lead poisoning. Here, as in gout, it is present at a time when no sign of nephritis can be noticed. Concerning this phenomenon, resembling that in gout, one may assume the same explanation, namely, a deficiency in the secretory power of the kidneys, or a kind of incipient and latent nephritis.

If one is not willing to accept the above explanation for the very early stages of gout, because of the absence of albuminuria, he must deny it also for the first periods of lead poisoning. Whatever interpretation avails in gout must also be admitted for lead intoxication. *In any case the mechanism of the accumulation of urates in the gouty blood is not a specific phenomenon of gout.*

Brugsch opposes this explanation on account of an experiment in which uric acid injected into the muscles of a gouty patient was eliminated just as completely and quickly as in a healthy man. I do not consider this objection to be conclusive. The gouty kidney, although not able to eliminate one gram of urates quickly enough on the *normal* level of urates in blood, might accomplish this task very well at the higher level already existing before the injection of uric acid. That this conception is right Widal has obviously proved by the example of the behavior of urea in nephritis.

Brugsch and Schittenhelm fall to a somewhat mystical explanation. They ascribe the accumulation of urates in the blood to a diminished destruction. But when a substance has once entered the blood, its elimination depends *only* on the relation between this fluid and the kidneys. I think the following argument will be convincing. On feeding sweetbreads, or during the absorption of

pneumonic exudates, the blood contains just as large a quantity of urates as does that of a gouty patient. Now, persons who do not suffer from gout will eliminate the excess of urates within a few days, and, even when adhering to a mixed diet, their blood will soon be free from urates. In gout, on the contrary, notwithstanding the ingestion of a purin-free diet, under the influence of which the formation and the influx of uric acid into the blood is much lower, uric acid will by no means disappear from the blood. Brugsch and Schittenhelm ascribe this to a retarded decomposition, though conceding that the total amount of uric acid breakdown is above the normal. Something is lacking in their theory, and they seem themselves to be aware of it. Although denying that the threshold (Schwellenwert) of the kidney for the output of urates is elevated in gout, they speak of a certain torpidity of this organ.

The deduction which ascribes the retention of uric acid to a damaged function of the kidneys, as enunciated by Garrod and adopted since by several authors, is rather repugnant to me as well as to pathologists in general. The disturbance which affects the entire organism would, according to this opinion, depend principally on the *passive* retention of a single metabolic product. This conception is not very satisfactory. I would be very pleased, indeed, if any other solution of the problem could be found. However, *rebus sic stantibus*, and without fixing my opinion for the future, I find no other solution for the problem than that given above.

This interpretation might terminate the unpleasant dualism in the theory of gout. The distinction between a primary metabolic and a primary kidney gout, which has always found supporters, from Garrod down to Brugsch and Schittenhelm, would become unnecessary by adopting this interpretation.

But against the doctrine of gout being due to deficient kidney functions, clinical doubts arise which we are unable entirely to remove. Why does not gout appear in each case of nephritis, why not in leukemia in which we always find an excess of uric acid in the blood? Many cases of interstitial nephritis progress so slowly that secondary changes, such as the deposition of urates and other abnormal phenomena, might have time to develop. Is perhaps the retention of uric acid present only in the later stages of contracting kidneys? We know nothing certain about this, nor about the supposed deficiency of the kidneys in gout. Does the condition reach back to youth, or even to childhood? The deficiency in that case would have lasted much longer than in any case of nephritis. At any rate, we must emphasize the fact that in many autopsies on uremic subjects concretions are found in the joints, without any history that the patients had ever suffered from primary gout. There is no doubt that organs other than the kidneys must play an important part in the pathogenesis of gout.

Of all the tissues, only the *joints* and the part they play in the

pathology of gout can be discussed in detail. Are the cartilages and the connective tissues implicated only in a passive way in gout, or are they active? Further questions to be answered are the following: By what mechanism and at what period does the deposition occur? What symptoms are produced by the precipitation of crystals, and what happens to the crystals during the paroxysm?

Contrary to the opinion of Ebstein, we may at present take for granted that the deposition of urates does not occur in necrotic, but only in living tissue (Minkowski, Freudweiler). And also in these deposition can only occur if the liquids which circulate in them are saturated with sodium urate. As to this point, whether the amount of urate of sodium in the blood corresponds to the saturation point, the opinions of most authors are or were erroneous. It was generally believed that the serum of the gouty patient is not saturated with urate of sodium. This assumption has been put forward on account of the experiments of G. Klemperer. He observed that 100 c.c. of normal serum can dissolve 150 to 200 mg. of uric acid, that is, ten times more than it ever contains during life. The serum of a gouty patient behaved in the same manner. This observation is correct—of that there is no question. But Klemperer failed to observe the reaction to its end; if he had done so, he would have seen after some time the abundant precipitation of urates. Serum, indeed, has the power of dissolving a good deal of uric acid by transforming it into urate of sodium, but only a small amount of the sodium salt is kept in solution. The problem has been attacked from a wrong direction. The biological question is not how much uric acid can be transformed by the alkalies of serum into urate of sodium, but how much sodium urate the serum is able to take up without precipitation. Roberts, in 1890, carried out experiments, and by the use of a correct method found that serum holds only a few milligrams of urate of sodium in solution. The figures found by Gudzent twenty years later were almost identical with those of Roberts, and with those Gudzent had in advance calculated theoretically that 100 grams of serum is saturated when containing 8 mg. of urate of sodium. If we apply these figures to the free acid instead of to urate of sodium, and to blood instead of to serum, we are surprised to see that 100 grams of blood is saturated when it contains 4 milligrams of uric acid. Such an amount has, indeed, been found in the blood of people suffering from severe gout, when on a mixed diet.

As to the point of saturation the conditions for precipitation are nearly always present. In the circulating blood, however, precipitation never takes place; it is prevented by its continuous movement and by the perpetual exchange of the urate molecules. While some of them pass to the urine, others enter the blood from the organs.

The Precipitation of Urate of Sodium. The conditions for precipitation are much more favorable within the lymphatics and

within the synovia of the articular cavities than elsewhere, for here the flow of liquids is very slow. I myself found 4 and 6 milligrams of uric acid in 100 c.c. of the fluid aspirated from inflamed knee-joints. But in spite of this saturated state one rarely finds crystals in suspension, and when such are encountered they may, perhaps, have originated from the impregnated cartilages which have undergone destruction, or from tophi which have forced a way into the articular cavity. As a rule, crystallization takes place only in the organized tissue.

By many it has been taken for granted that the cartilages possess a *specific* power to attract dissolved urate of sodium and to bring it to crystallization. However, the phenomenon can also be produced by excised cartilaginous tissue. This was shown by Roberts many years ago, and later by Almagia and Brugsch. Tarsal bones of a pig were suspended in phials charged with a saturated solution of urates; after a few days they were encrusted with needles and presented an aspect which, in intensity and distribution of deposits, resembled that of a gouty joint. The process of precipitation is thus not a vital one, but is purely passive, brought on by certain chemical relations and properties still existing in the dead cartilaginous tissue. But possibly even this chemical reaction is not of a complicated order. Roberts, in a purely experimental way, showed that the solubility of sodium urate decreases with increasing concentration of sodium salts in the liquid. The theory of solution agrees fully with the actual experiment. An addition of 0.2 per cent. of sodium chloride to a saturated solution of urate of sodium brings about precipitation. Roberts and Gudzent noted that cartilage, tendons, etc., are richer in sodium salts than the blood serum. Their sodium content reckoned as sodium chloride rises to 0.9 per cent., while in serum it is only 0.7 per cent. When the lymph saturated with urate of sodium penetrates into the cartilaginous tissue where the concentration of the sodium ions is higher, a state of supersaturation is brought about, and precipitation can take place. In this hypothesis the supposition is made that the sodium exists in the state of ions in the cartilages. Whether this is true or not is unknown. If it does not thus exist, if it be united to an organic compound, the explanation of Roberts and Gudzent would not hold good.

In response to the question why precipitation does not occur in all joints—their chemical composition being the same everywhere—we must refer to mechanical and thermal injuries, the influence of which on the localization is clearly proved by daily experience, even though we do not find such explanations satisfactory.

But the nephritic patient is exposed to the same influences. Why does not precipitation occur in every man suffering from contracting kidneys? For the second time we are obliged to put this question. If the retention of uric acid in the blood is a passive process,

if the deposition within the tissues is a purely physical process, by what properties is gout then to be characterized?

There must be an active element in its pathogenesis belonging exclusively to the gouty diathesis. What then is this active principle? Science as yet gives no answer to this question, which touches the kernel of the problem. Therefore, I will not attempt to present any hypothesis. Surely an hereditary influence exists in gout and a neuropathological influence is present besides the chemical or humoral-pathological. The clinician must always be aware of this. But so long as we cannot determine the mechanism by which the nerves act on the metabolism in gout, no scientific advantage results from emphasizing such an influence.

All organs yielding or destroying uric acid (and they are many) were at one time thought to be implicated in the phenomena of gout. Thus, a predominant part was formerly attributed to the liver, to the bowels, or to the spleen, etc. But their influence, if indeed any exists, is not a directly controlling one over the uric acid metabolism. It is for the present worthless to search for increased or for decreased destruction in the single organs, since we know that *as a total* the uric acid metabolism always remains within the ordinary limits. If muscular work prevents paroxysms or lessens their violence this need not be referred to an increased destruction of uric acid, but rather to an immediate action on the joints, changing the quantity of synovial liquid or its composition, or the rapidity of its circulation. The action of other organs too might be indirect.

Thus the so much sought for active principle which causes gout remains a mystery, not to be unravelled by our present means. Leaving the solution of the problem to the future, we return to the fate of urate deposits. We can discuss apart this question without regard to the problems of gouty diathesis and pathogenesis.

THE RELATION BETWEEN THE ATTACKS AND THE URATE DEPOSITS. At what time does precipitation take place? Is it a chronic process going on continuously, or does it depend upon attacks and in what manner is it connected with them? When considering those tophi, the fate of which we can trace with the eye, we know that they may appear, grow, and disappear without the bearer knowing anything about it. Especially the larger deposits, those upon the hands, grow with hardly any inflammatory reaction. But this fact does not absolutely exclude a relation between the precipitating process and the attack. The same process which on slow development causes no strong reaction, may induce the most violent symptoms if the onset is one of great intensity.

According to Garrod the attack is provoked by a sudden precipitation of crystals in the tissues. The attack consists merely of such deposition of urates and of the inflammation induced by their presence. The deposits, once formed, remain for a long time, often throughout life. "When crystallization of the salt takes place

in any tissue, inflammation is suddenly lit up by its presence and a paroxysm of gout ensues." Roberts is of the same opinion.

There is one objection which renders it difficult to consent in this respect to the authority of the eminent English clinician. One of the chief rules of chemistry *corpora non agunt nisi soluta* is applicable also to the conditions in the organism. If the uric acid salt is precipitated, the chemical influence of the solid material upon the tissues stops instantly and does not reappear until it is dissolved again. In the meantime its action is purely physical. The mechanical irritation may perhaps be stronger at the moment of crystallization and during the growth of the crystals than in periods of absolute rest. But the pressure which the crystals exert upon the tissues is scarcely sufficient to bring about a serious reaction. Garrod's opinion is just as improbable to me as the hypothesis which refers the symptoms of bronchial asthma to an irritation of the air conduits by Charcot-Leyden crystals. In opposition to the English authors, I am rather inclined to ascribe the irritation to the dissolved urates. According to this conception a sudden increase of their concentration would induce the inflammation.

This supposed rise of the amount of urates within the synovia could be brought about in a twofold manner. According to Garrod's opinion it is only a part of the general urate accumulation in the whole body, induced by a deficient excretion. The urate molecules would pass from the serum to the synovia and thence to the cartilages. However, a contrary conception could also be supported. A rapid solution of the deposits might lead to an increased concentration in the synovial liquid, thus perhaps explaining the violence of reaction better than the hypothesis of Garrod. As to the question why a solution of deposits should occur so rapidly, I own I am not able to reply.

The above conception is an elaboration of Pfeiffer's ideas somewhat changed. In opposition to Garrod, Pfeiffer considered the attack as consisting of a solution and removal of the deposits of urate. He based his opinion upon reasons which do not seem to me to be justifiable. Still his idea as a whole seems to me probable, and for the two following reasons:

1. The inflammation spreads far beyond the places of the crystalline deposits. One may find an aspect of the skin fully resembling a phlegmon, and even a severe lymphangitis, which, though aseptic, has sometimes misled the surgeon. This proves that an irritating substance is carried away from the afflicted joints. If the sodium urate is really the inflammatory agent in the joints, it seems likely that the irritation of the more distant tissues is caused by the same substance, carried away through the lymphatics.

2. The second reason in favor of Pfeiffer's views is the excess of endogenous uric acid excreted during the attack. The excess is far greater than the diminution preceding the paroxysm. In one

of my observations the surplus eliminated in eight days of a violent attack amounted to more than 3 grams. Although the origin of these urates cannot be pointed out with accuracy, it may probably be attributed, in whole or in part, to a solution of the crystalline deposits.

I might also lay stress upon the fact that, in aspirating the joint exudate as completely as possible, the last portions, originating from the interior parts of the cavity, are always found to be richer in leukocytes than the first portions. And it is well known, that leukocytes are the instruments for attacking the urate crystals as well as the vehicles for their removal. Perhaps the theory of Garrod and that of Pfeiffer might be combined in such a way as to assume that a general retention of urates provokes the outbreak of an attack, and that the inflammation which follows leads to a removal of the deposits.

Peculiar Exciting Causes of the Attacks. The accumulation of uric acid in the fluids of the body, supposed by Garrod to precede and to provoke the attack, has not yet been demonstrated by analysis of the blood itself. If it were possible to determine the uric acid in the blood day by day before and during the paroxysm, we would be able to judge the part played by the accumulation of urates better than we can now. We are at present obliged to rely upon analysis of the urine. The decrease of the uric acid output in the twenty-four hours prior to the attack, which amounts to from 100 to 200 mg., may be interpreted as meaning an accumulation in the body; but sometimes this decrease is altogether lacking. The best support of this part of Garrod's theory is to be found in the more recent observations that consumption of sweetbread *sometimes* brings about the paroxysm. It may be asked whether this coincidence is not merely accidental. In spite of such doubts and gaps, this part of Garrod's doctrine is generally acknowledged and accepted.

However, this is not true with regard to the second part of his theory. Garrod assumed a decreased alkalinity of the blood to be the second cause exciting the gouty attack. *This part of his doctrine should be dropped entirely.* It is refuted by actual examination of the gouty blood as well as by proofs in the test-tube, and it is contradicted also by the doctrine of physical chemistry. In measuring the alkalinity of the blood by means of titration in more than twelve patients before, during, and after the paroxysm, and also during the intervals, I failed at any time to find any marked difference. Moreover, all chemical analogies teach us that an addition of hydrochloric acid to the solution of any salt may bring about precipitation of the *free* acid, but never that of the *salt*. If we had to deal with bisodium urate, the addition of an acid would produce its conversion into monosodium urate, and this, being less soluble than the original salt, would crystallize out. This would be the

same process as the precipitation of monosodium sulphate produced by adding sulphuric acid to a solution of neutral sodium sulphate. But please remember, gentlemen, that in the serum only monosodium urate is present, which, according to the above exposition, is not precipitated as such by acids.

Roberts' test-tube experiments correspond fully with these theoretical deductions. Serum contains about 0.5 per cent. of sodium chloride and 0.2 per cent. of monosodium carbonate. The addition of hydrochloric or acetic acid to serum saturated with urate of sodium brings about a precipitation of uric acid. If, on the other hand, sodium carbonate be removed from the serum by dialysis, not the slightest crystallization occurs, although the serum has lost its alkalinity. On the other hand, the addition of monosodium carbonate to the serum causes precipitation, although this be contrary to Garrod's opinion, and in spite of the high increase of the so-called alkalinity. The solubility and the precipitation of urate of sodium have nothing at all to do with the alkalinity, but depend merely on the concentration of sodium ions or salts in the solution. Indeed, the addition of sodium chloride effects a precipitation just as well as does monosodium carbonate.

The question of diminishing alkalinity is of the utmost importance for the precipitation of uric *acid* in urine; it is predominant in the pathogenesis of *gravel*, but it must be excluded entirely from the theory of gout. It has to be replaced by the factor of salt concentration, and especially of the concentration in sodium ions. Please remember, gentlemen, in connection with these explanations, the conception of Roberts that it is the high amount of sodium salts in the connective tissue which very likely determines the place of the crystallization of urates.

It will be hard for many to drop entirely the doctrine of the importance of a varying alkalinity of the blood in gout. One may feel inclined, perhaps, to found his conservatism on the valuable experiments of Loghem. This Dutch scientist has found that deposits of uric acid, produced by hypodermic injections in the rabbit, are soon converted into deposits of urate of sodium, and that this transformation is followed by a serious inflammation. In dogs this transformation is not observed, nor any inflammation. The metabolism of the rabbit kept on green food is, roughly speaking, an alkaline one. In the same sense, we might apply the term of an acid metabolism to a dog fed with meat. According to this difference the fate of uric acid injected varies in the two species. But if the dog has been given 20 grams of sodium carbonate, his metabolism becomes more alkaline, and the conversion of the uric acid into urate of sodium takes place exactly as in the rabbit. Vice versa, in the rabbit it is prevented by administering hydrochloric acid. The results of the older experiments of Pfeiffer and the later ones of Silbergleit coincide fully with those of Loghem.

In these experiments the influence of acids and alkalies upon the chemical occurrences in the body are evident. In many respects these experiments are of high value, and have justly attracted attention. However, the observations have nothing to do with the conditions in gout. In Loghem's experiments an entirely different problem was attacked, namely, the transformation of uric acid into urate of sodium. It is obvious that the transformation is favored by an excess of alkalies in the body, as well as in the test-tube, and that it is retarded or prevented by an increase of acid substances alike in the body and in the chemist's phial. As to the solubility and precipitation of urate of sodium, Loghem's experiments prove just as little as Klemperer's experiments about the degree of saturation of serum with urate of sodium.

THERAPEUTICS. If I now consider the therapeutics of gout, I must of course confine myself to the discussion of such points as bear relation to the metabolism of uric acid.

The two drugs which are the most efficacious in the paroxysm, colchicum and salicylate, behave entirely differently as regards the elimination of uric acid. Salicylates in sufficient doses increase the output of uric acid materially, by half a gram and more daily. This effect, however, seems to disappear within a few days. Colchicum, which, no doubt, is the stronger remedy, produces no change, or, if so, it diminishes the quantity of uric acid elimination. I do not believe that these two drugs, the chemical effects of which are so different, owe their efficacy to the same pharmacological action. One should try to define the mechanism of their action. Setting aside their soothing capacity, I shall only discuss their action upon the uric acid within the body.

If, according to Pfeiffer's opinion, the attack were a process of solution and removal of urates, one could conceive that salicylates favor the elimination, since increased uric acid output follows the administration of these substances. But we do not know whether this increased output originates from the deposits. Even healthy persons when taking salicylates show a slight increase of uric acid elimination. Comparative experiments with this remedy ought to be made on a large scale upon healthy and gouty people.

As to colchicum, one might think that it inhibits the process of solution, thus putting an end to the inflammation and to the paroxysm. Its effect is certainly more rapid and more intense than that of sodium salicylate. If this conception were right the colchicum would be only a palliative for the attack, while the salicylates, in spite of their slower action, would be the preferable remedy. It is well known that colchicum is useless in chronic gout. If the attack be interpreted in the sense of Garrod, the efficacy of both drugs would have to be explained otherwise. A discussion of this subject bears as yet the character of mere conjecture. Therefore, I do not wish to enter into details. I have felt that the ideas were

worth mentioning in order to encourage investigations on these points.

Alkalies and acids are not given during the attack, at least not in large quantities. However, considering the importance of these substances in chronic gout, their application should be tried and observed during the paroxysm also. In recommending them I do not expect any therapeutic effect. Indeed, in one of my patients the largest doses of hydrochloric acid did not influence either the pains or the inflammation, which is contrary to the results observed in the experiments of Loghem. In administering alkaline carbonates during the attack, I do not expect a curative effect either. I merely think that the comparative investigation of the action of acids and of alkalies during the attack should also throw some light upon their action in the chronic stages.

In the therapeutics of chronic gout, restriction of meat in the diet has been in use since olden times. This treatment is older than our recent knowledge of uric-acid metabolism. In lessening the formation of exogenous uric acid, we only practise today what the old physicians practised with less precise ideas. However, the extremists of today do not even go so far as to forbid meat entirely. Empiricism shows that the disadvantages induced by an exclusive lacto-vegetarian diet prevail over the benefits which could be expected from a diminished formation of uric acid. Generally we prescribe a diet poor in purins. Investigations of the purin metabolism during years of strict adherence to such a diet will teach us to indicate its application with more accuracy. Repeated analyses of the purin compounds in the blood are needed as well as balances of the purin intake and output, and also repeated investigations of the behavior of ingested nucleic acids. Hospital patients are not very well fitted for such researches which have to be extended for years. It is fortunate that wealthy patients of today are inclined to enter the clinics and sanatoria, and willingly to undergo longer observation. They have an appreciation of the importance of such investigations. However, it will take a decade at least before sufficient data concerning the behavior of uric acid in the urine, blood, etc., collected from a sufficient number of patients, will be at our disposal. We can look forward to this time with great hope.

Of all remedies deemed useful in chronic gout, alkalies have for centuries been applied more than all others. Two theories as to their value have existed. Regarding the first, it was believed that alkalies dissolve the concretions of urates within the body. I have already explained to you that this idea has been entirely refuted by modern research. The second quality ascribed to the alkalies was their power of facilitating the output of uric acid. This surely should be of benefit. But experiments carried out in this direction do not speak at all in favor of the conception. In therapeutics,

however, the first principle for the practitioner as well as for the scientific observer is to observe and to judge therapeutic effects with impartiality, leaving aside both prejudice and theory. If empiricism should speak in favor of the alkalies, another theory is required, without need of change in therapeutic treatment.

Cool judgment, however, is more difficult in the therapeutics of gout than in any other disease. There is a lack of a pronounced criterion by which we may measure the effects of our prescriptions. In diabetes we measure the amount of sugar eliminated, in obesity the changes of weight. In nephritis, and in cirrhosis of the liver, and in diseases of the circulation, the increase or decrease of effusions and the height of the blood pressure represent the criteria of therapeutics. Even in tuberculosis and in syphillis, the course of which is so difficult to judge, there are still better points of support for judgment than in chronic gout. As yet we are allowed to judge the results of therapeutic action only by the measure of diminished urate of sodium excretion in the urine. Probably a diminished amount of urates in the blood represents a standard of improvement, but as yet this criterion is not available, and for obvious reasons. Thus, the measure by which we may now judge of lasting improvement consists merely in a postponement of the attacks, in a lessened intensity of the paroxysm, and in a diminution of chronic troubles. Regarding this point I can only repeat Roberts' words: "The incidence of diathesis even in fairly typical cases exhibits a waviness, an afflux and reflux, which is very puzzling. In the less typical cases the irregularity is such as to baffle all explanation. In most instances the manifestations become intensified with advancing years, but sometimes the converse is observed. All these perplexing vagaries are within the compass of the natual history of the disorder."

Even if a physician may dare ascribe the improvement of a gouty patient's health not to nature itself, but to his own prescriptions, to which of them is he allowed to attribute this success?

All procedures which we believe to be beneficial in gout, namely, the restriction of meat diet, the choice of green food, muscular exercise, the use of baths, all these prescriptions are generally given at the same time and accompanied by the administration of drugs; and even these the most conservative physician and patient will change time and again. Similar objections are to be borne in mind in judging the effect of alkalies. Roberts, in whom scientific criticism was united with the abilities of a born physician, asserts that in a long experience he had never seen any distinct improvement even after administering alkalies for many years.

What remedy can be substituted for alkalies? You all know, gentlemen, that a German practitioner, Falkenstein, has pleaded for the entire abolition of alkaline treatment and recommended instead the administration of hydrochloric acid. His ideas of gout and of its therapeutics stand on a very weak foundation. However,

success is the decisive factor. Falkenstein reports that after years of severe trouble he finally got rid of his pains by the use of hydrochloric acid, without having changed his mode of living, his diet, or his habits. Such a report deserves every attention, even though this new therapeutic method might not benefit every patient. Falkenstein asserts that he has obtained good results in many patients. Other physicians have been less successful. Thus, we must leave time for further observations.

I wish to add a few more words regarding the use of mineral springs. Physicians are inclined at present to ascribe the undoubted efficiency of mineral waters not to the content of salts, but to the emanations of radio-active substances. Gudzent has observed that radio-emanation was able to destroy uric acid. It has been hoped that such influence is also active in the organism of gouty patients. Since the emanation leaves the body rapidly with the expired air, Löwenthal constructed a respiration chamber, in which the amount of emanation was kept at a high level. Thus, the quantity of radio-emanation from men rose to 150,000 units. Preliminary experiments were carried out last winter by Löwenthal and Gudzent in the clinic of Prof. His. The results have not been published in detail, so judgment is somewhat difficult. In healthy persons the output of uric acid was materially increased, but gouty patients behaved differently. There was a marked improvement of health, but it was not possible to refer this to a distinct change in the uric acid metabolism. In experiments with animals, however, the influence of radio-emanation was more conspicuous. The symptoms of inflammation produced by hypodermic injections of uric acid in the rabbit were modified under the influence of the emanations; leukocytosis and phagocytosis were retarded for several days. By this observation the marked influence of radio-emanation on the occurrences within the organism is established beyond every doubt. It may be hoped that investigations of this kind will advance our knowledge of theory as well as of therapeutics. Thanks to Löwenthal's ingenious apparatus, it will soon be possible for any hospital to avail itself of these new resources.

Since the production and destruction of uric acid, like that of other chemical substances, are the work of protoplasm, it is for future research to study the lesions in the protoplasm itself, and to reveal the mechanism which leads to a derangement of the metabolism. At present we only recognize the results and the chemical products of this derangement. In gout also the researches must rise from the present level to investigations of a higher order. But this is the same in every field of pathological metabolism. When, on looking back after a lapse of twenty future years, we shall have advanced into a more profound region of knowledge, we shall not regard the older investigations on uric acid as having been done in vain.

THE ELECTROCARDIOGRAM IN CLINICAL MEDICINE.

II. THE ELECTROCARDIOGRAM IN SOME FAMILIAR DISEASES OF THE HEART.

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In the preceding section of this communication[1] we have seen that the electrocardiogram in health is a curve whose general character, though subject to individual variations, is much the same in all normal persons. As might be expected, this curve is subject to very marked alteration in various diseases of the heart, and for the practical physician it becomes a matter of great interest to know what information, expressed in terms of anatomical change or alteration of function, can be derived from the study of the pathological electrocardiogram.

In considering the factors which bring about change in the form of the electrical curve, it must be constantly borne in mind that this curve is purely the expression of changes in the electrical condition of the heart, due to muscular activity. Movements of the blood or mechanical disturbances of valves have no direct effect on this record.

It has been previously shown that the character of the curve varies with the points of the body surface from which the current is led off. A theoretical consideration of the physical laws which determine the spread of potential would carry us too far afield. It may be stated as an observed fact that variations in the position of the heart within the chest will also cause marked changes in the form of the electrocardiogram.[2] Similarly, marked changes in the shape of the muscle mass affect the curve. Still more striking variations are those caused by contractions which originate in abnormal situations and pursue an abnormal course through the muscle.

We shall present records of some of the more common of these conditions with such comment on their interpretation and significance as seems desirable from the standpoint of the practitioner of medicine.

Hypertrophy. Our knowledge of this subject is at present largely empirical, and analysis of the exact conditions which bring about the observed changes is beset with very considerable difficul-

[1] Amer. Jour. Med. Sci., 1910, cxl, 408.
[2] Einthoven, Weiteres über das Elektrokardiogramm, Pflüger's Archiv, 1908, cxxii, 533.

ties. Further study may eventually permit such an analysis, but for the present we shall confine ourselves to a description of the form of the curves with which we find hypertrophies associated.

As has been previously shown,[3] in leading the current from any pair of the three extremities customarily chosen, the three principal peaks, P, R, and T, are usually directed upward in normal subjects. The tall peak R is of especial interest in hypertrophy, and we shall refer to R in lead I as R I, in lead II as R II, etc. Normally all three are directed upward, and of the three, R II is usually of greatest height, R III of least. It has been shown by Einthoven,[4] and confirmed by others, that in hypertrophy of the right ventricle, R I is very small in extent upward, or may be directed downward, usually the latter in well-marked cases; at the same time R III is directed upward, and is relatively of greater magnitude than in normal subjects (Fig. 1). In hypertrophy of the left ventricle, the opposite condition obtains, R I being directed upward, and often of enormous height, while R III is directed downward, frequently to the extent of 2 cm. (or 2 millivolts) (Fig. 2).

As before mentioned the theoretical explanation of these facts is difficult, and in the absence of more definite knowledge, extensive speculation would be unprofitable. The empirically determined facts that a downward directed R I with upward directed R III signifies right ventricular hypertrophy, and that an upward directed R I with downward directed R III means left hypertrophy, are of the greatest clinical significance. While in most cases the ordinary methods of physical examination suffice for a diagnosis of left hypertrophy, the determination of right hypertrophy is not infrequently a matter of much uncertainty, and with thick chest walls, emphysematous lungs, or in the presence of fluid, consolidation, or newgrowths, the difficulty may be unsurmountable.

So far as we know at present, the only conditions, aside from hypertrophy, which can produce a similar electrocardiogram, are changes in position of the heart in the chest and lesions of one limb of the auriculoventricular bundle. It has been found by us that to produce, by change in position of the normal heart, changes comparable to those caused by hypertrophy, requires a very considerable displacement of the organ. As this will form the subject of a subsequent communication, it will not be dealt with in detail here. Such anomalies of position, however, are of comparatively infrequent occurrence as congenital phenomena, and, as a rule, pathological conditions which could cause marked alteration in the position of the heart present little difficulty in diagnosis. We shall have occasion to consider lesions of one limb of the bundle of His a little later.

[3] James and Williams, The Electrocardiogram in Clinical Medicine, part i, AMER. JOUR. MED. SCI., 1910, cxl, 408.

[4] Le Télécardiogramme, Archiv. internat. de Physiol., 1906, iv, 147; Weiteres über das Elektrokardiogramm, loc. cit., S. 553.

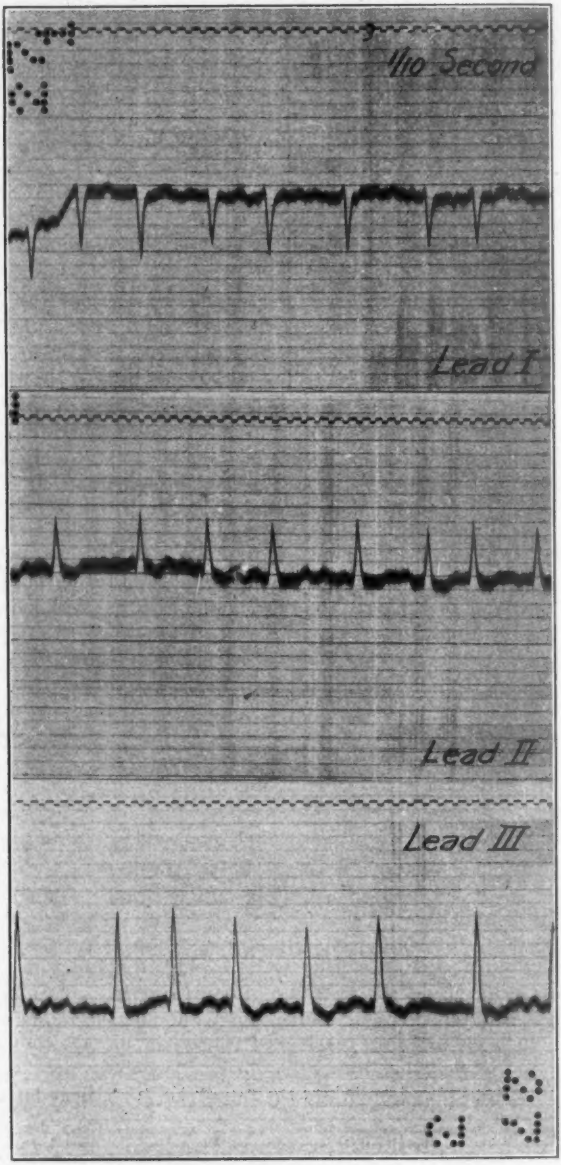

FIG. 1.—Reversal of $_{\Delta}$R I, in hypertrophy of the right ventricle. The heart is completely irregular and waves of auricular fibrillations appear. (See Fig. 9.)

Concerning hypertrophy of the auricle, our knowledge is less definite. It may be assumed to exist in the left auricle in cases of well-marked mitral stenosis with good compensation, and in some

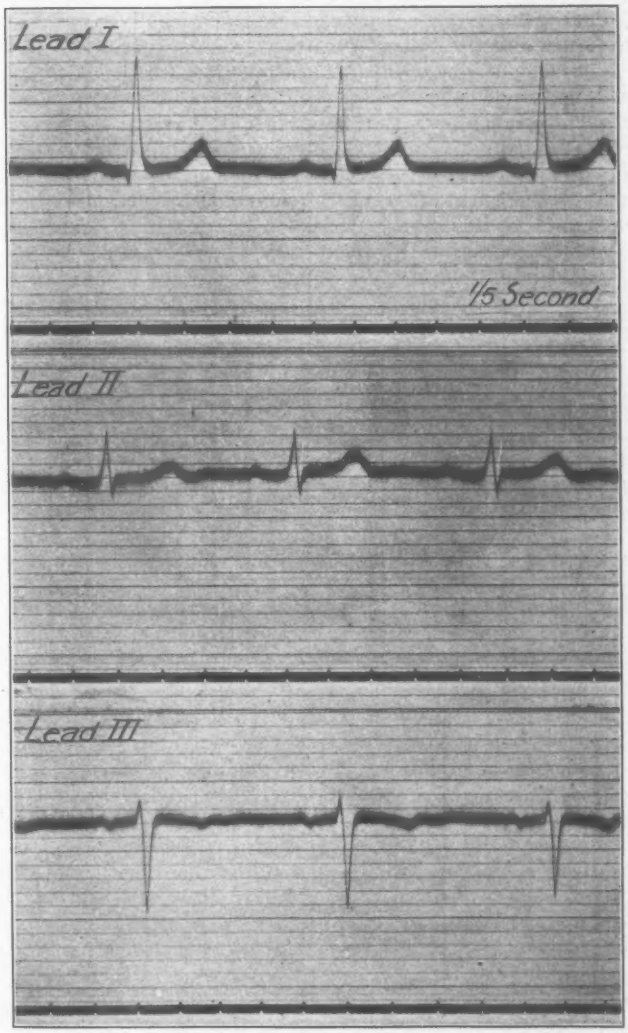

FIG. 2.—Hypertrophy of the left ventricle in mitral insufficiency.

of these cases a decided increase in the magnitude of the wave P has been noted.

In the discussion of hypertrophy we have followed Einthoven's nomenclature, referring to the principal sharp peak as "R," whether directed up or down. Some writers have recently referred to the downward directed wave as "S," but in the absence of exact knowledge of the underlying causes of the change, we feel that the confusion resulting from change in nomenclature is not balanced by any well-defined advantage.

DISTURBANCES OF RHYTHM. Irregularity in the cardiac rhythm has long been familiar as an accompaniment of cardiac disease, and during recent years the study of simultaneous arterial and venous sphygmograms has clearly shown that irregularity may arise in several different ways. Though some of these types of irregularity permit of immediate and easy diagnosis from the sphygmograms, and nearly all of them can be distinguished by close study, their essentially different characters are especially well marked in the electrocardiograms.

Cardiac irregularity may arise as the result of variations in the intensity of vagus innervation. As MacKenzie[5] has pointed out, this irregularity most frequently takes the form of an occasional slowing of the pulse, often occurring at the time of inspiration, as though it were a reflex increase in vagal innervation. In such cases the electrocardiogram shows only a lengthening of the diastolic interval, the interval between T and P, without other change.

Irregular acceleration of the auricular rhythm has usually been ascribed to the occurrence of auricular extrasystoles. MacKenzie takes this view, and from his definition of an extrasystole as taking origin in some part of the heart other than the sinus region, we presume that he considers the site of origin of these accelerated auricular beats to be always some part of the auricle other than the place of origin of the regular rhythm. While this is unquestionably true in some cases of irregular auricular acceleration, we can see no reason for the assumption that the sinus region itself may not in some cases initiate a premature beat. It is well known that vagal control affects principally the auricles, and if an occasional increase in the strength of vagus tone will cause a delayed beat, it seems reasonable to suppose that the reverse may be true.

Fig. 3 is the electrocardiogram of a patient who has occasional premature beats of auricular origin. Such a premature beat is shown at 1. It will be seen that the P or auricular wave of the electrocardiogram, follows so closely on T of the preceding ventricular phase, as partially to merge with it. The ventricular phase corresponding to this premature P is entirely similar in form to those of the normal rhythm. There is a slight lengthening of the

[5] The Study of the Pulse, London and Edinburgh, 1902.

succeeding diastole, but certainly not enough to entitle it to be considered a compensatory pause in the usual acceptation of that term. Furthermore, the radial pulse at the time of these premature beats is as strong and full as at any other time.

This patient presents the clinical evidence of aortic regurgitation, with some mitral stenosis. Compensation is good and there is little evidence of hypertrophy, a clinical finding which is confirmed by the absence of reversal of R III in the electrocardiogram. He has had occasional attacks of tachycardia, usually induced by the swallowing of very cold liquids. The record was taken during a period of comfort, with normal pulse rate. The fact that there is but slight hypertrophy, and the character of the irregularity, seem to indicate that the integrity of the heart muscle is fairly well preserved. It is possible that the attacks of tachycardia in his case

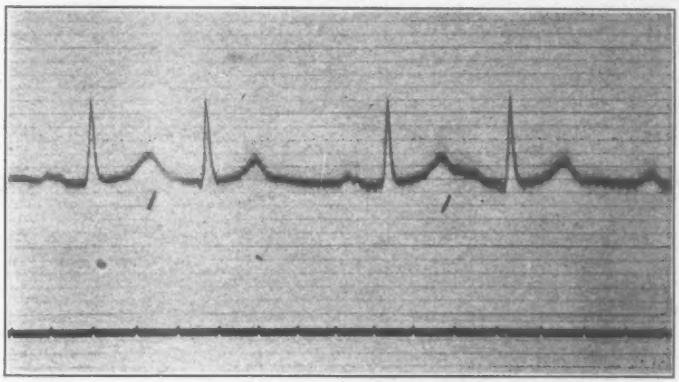

FIG. 3.—Irregularity due to premature auricular (sinus?) contractions.

may have their origin rather in disturbance of the inhibitory or accelerator nervous mechanisms than in an altered condition of the auricle itself.

Fig. 4 is from a young man, aged nineteen years, in whom cardiac irregularity was discovered during a routine examination at his college gymnasium. At (1) it will be seen that a premature beat occurred. Its auricular origin is evidenced by the alteration in form of the preceding T, which is seen to be increased in height, and bifid. The succeeding ventricular cycle presents a little variation from the normal form. It will be noticed that there is an increase of some 4 mm. in the height of R, while T is markedly diminished in height —about 2 mm., as compared with the normal 4 mm.

In this instance an impulse starting in the auricle produces an anomalous contraction of the ventricle. This is difficult to understand in the light of our present conception of the physiology of the

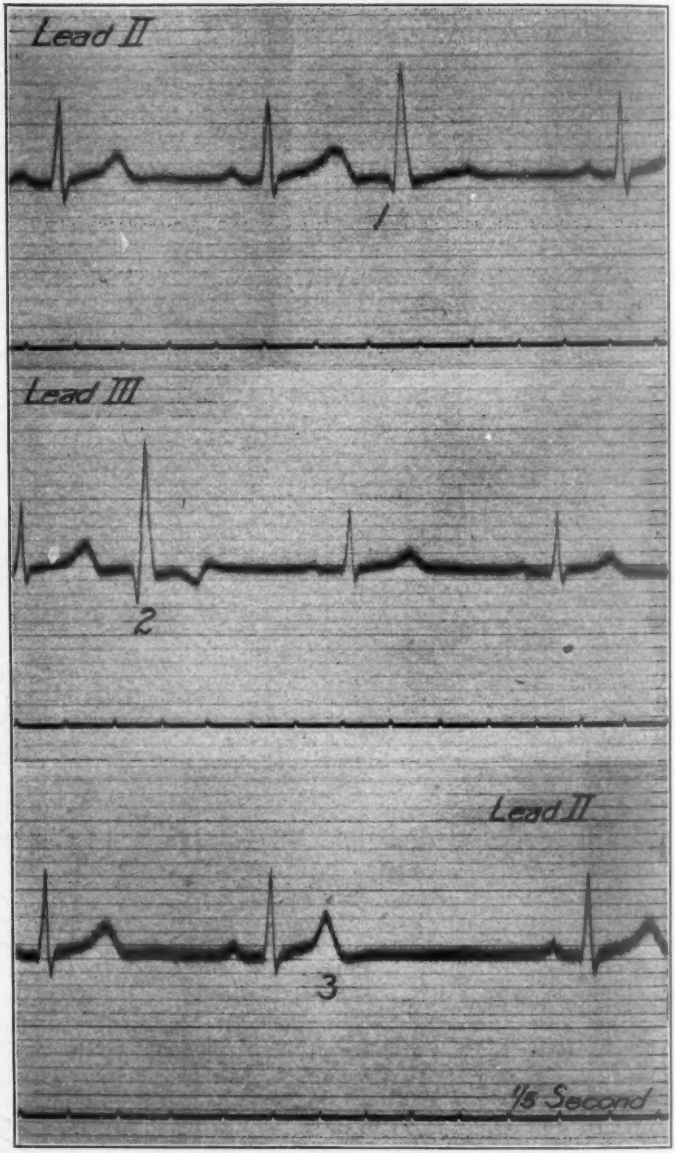

FIG. 4.—Auricular extrasystoles at 1, 2, and 3. The auricular extrasystole at 3 fails to provoke a ventricular rseponse.

auriculoventricular bundle. We have been wont to presume that all impulses reaching the ventricle by way of the bundle would produce therein the same effect, no matter what their origin in the auricle. Evidence is accumulating which tends to indicate that the relations of the bundle to the auricle are less simple than anatomical studies would lead us to presume.

Lewis[6] has called attention to the fact that the form of the ventricular electrocardiogram evoked by an auricular extrasystole may differ from the form evoked by the normal auricular activity, and further, that in the same subject auricular extrasystoles may evoke more than one anomalous type of ventricular activity. Quite possibly, further study will show that the bundle consists of fiber strands which converge from different parts of the auricle.

At (2), Fig. 4, another auricular extrasystole is shown, followed by a ventricular phase, which departs even more from the normal. At (3) is figured the electrocardiogram of another premature beat. Here the premature beat is indicated only by alterations of the preceding T, and a long pause following. The preceding T is increased fully a millimeter in height, and is not bifid, its top presenting a peculiarly sharp point. Here the premature contraction has occurred so early as to fuse its electrical activity completely with the final phase of the preceding ventricular cycle, and so early as to find the ventricle still in the refractory phase; or, what is much the same, that the conducting paths were refractory as a result of the immediately preceding cycle. The fact that the deformation of the T wave is of the nature of a reinforcement shows that the electrical disturbance caused by the premature auricular contraction was of the same general character as that attending normal beats. In other words, the muscle contraction passed from base toward apex in the auricle.

In Fig. 5 the premature contraction at (1) is distinguished from the normal beats, aside from its prematurity, by the fact that the auricular phase of the electrocardiogram is in the reverse direction from the normal. All the P waves of the regular rhythm are seen to be directed upward, indicating passage of the contraction wave from base toward apex in the auricle. In all the premature beats in this case the P wave is reversed, indicating an origin of the premature beat at a point nearer the ventricles than the site of the normal rhythm.

In this instance there can be no doubt as to the ectopic origin of the early beat, and it is especially interesting to find that in the ventricular response there is a marked departure from the type evoked by auricular impulses of the normal rhythm. It is plainly to be seen that the wave T is of very small magnitude throughout the

[6] Paroxysmal Tachycardia, the Result of Ectopic Impulse Formation, Heart, 1910, i, 262, 282.

normal rhythm, but that the ventricular response to each ectopic auricular beat presents a T wave of much greater height.

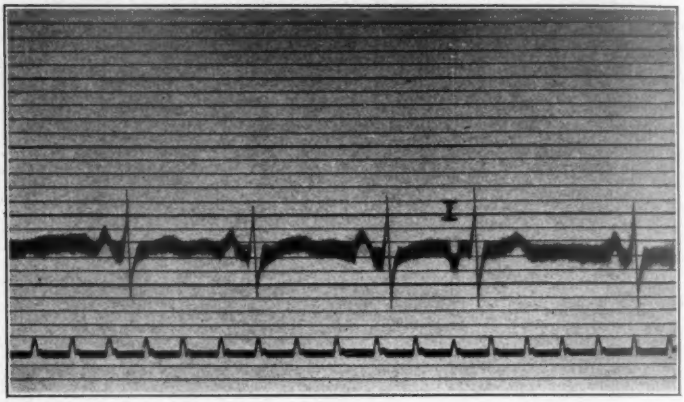

FIG. 5.—Auricular extrasystole (*I*). The reversal of the P-wave indicates that the contraction wave travels in the reverse direction.

EXTRASYSTOLES ORIGINATING IN THE VENTRICLES. Ectopic beats originating in the ventricles give rise to electrical phenomena of various types, according to their place of origin. From anatomical considerations we should expect ectopic beats originating in the auriculoventricular bundle above its division into right and left limbs, to give an electrocardiogram not very different from the ventricular portion of the normal electrocardiogram in the same individual. Since the contraction wave must spread through the ventricular masses in the same manner as a normal contraction wave, it seems reasonable to suppose that the resulting systole will be in every way similar to the normal ventricular systole and attended with a similar electrical complex. In cases of complete heart block, in which the ventricle assumes an independent rhythm, it is found that the ventricular electrocardiogram is of about the same form as the ventricular phase of a normal curve. Records of two such cases have been published by Einthoven.[7]

The tissue of the bundle below the block seems to be the most irritable part of the ventricle, and therefore determines the point of origin of the contraction.

The greater number of ventricular extrasystoles, however, gives rise to an electrical complex entirely different from anything found in the normal electrocardiogram. Einthoven[8] has referred to these contractions as "atypical contractions." The most striking features

[7] Le Télécardiogramme, loc. cit., Plate 3.

[8] Ibid., pp. 151 to 155.

of these atypical electrocardiograms are the abnormally large magnitude of the differences of potential and their close resemblance to the diphasic variation which results when a single muscle wave traverses a piece of skeletal muscle. The form of the atypical curve varies with the lead chosen and with the site of origin of the beat, as may easily be proved by animal experimentation. It is a fairly uniform characteristic of the atypical contractions that the magnitude of the recorded electromotive forces is greater than is the case with normal contractions in the same individual (Fig. 6).

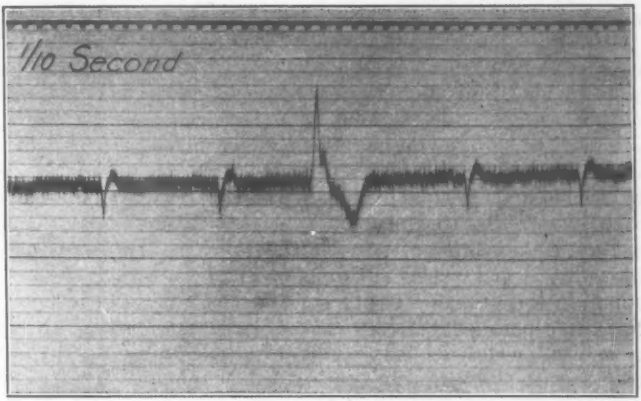

FIG. 6.—Ventricular extrasystole.

In attempting to understand these facts we shall find it helpful to consider the factors which contribute to the formation of the normal electrocardiogram. The anatomical distribution of the bundle suggests, as pointed out by Einthoven,[9] that the ventricular systole is not simply a contraction wave passing from base to apex, but that the impulse normally reaches many parts of the ventricle at once. We may almost think of the bundle as a sort of primitive motor nervous system connecting auricles with ventricles. The normal ventricular contraction is a coördinated, more or less complicated action. The arrangement of the ventricular muscle fibers is complex, and if we conceive that the normal mechanism of contraction consists in the simultaneous activity of a large part of this musculature, it becomes evident that in different parts of the ventricle muscle waves will be travelling at the same instant, some in one direction, others in another. The electromotive forces resulting from the activity of muscle fibers, in which the direction of propagation of the wave is the same, will be added, while the electrical

[9] Weiteres über das Elektrokardiogramm, loc. cit., 576.

effect of muscle waves passing in an opposite direction will be subtracted. The total effect at any instant will be the algebraic sum[10] of all the electromotive forces. The maximum electromotive force measured is not necessarily a criterion of the maximum muscular activity. It might conceivably happen that at the time of maximum muscular activity the electromotive forces would nearly balance each other.

To restate the matter briefly, the form of the ventricular electrocardiogram appears to be the expression of the algebraically summed electrical effect of several contraction waves passing simultaneously in various directions through the musculature.

So long as the ventricular systole is initiated through the intermediary action of the bundle, the contraction complex will be constant—except as noted above in the cases of certain auricular extrasystoles.

In the light of these considerations, such a curve as Fig. 6, which is the electrical expression of a ventricular extrasystole, becomes comprehensible. We see that the magnitude of the electromotive forces is much greater than the magnitude of the maximum electromotive force of the normal beats; also, that the curve is a diphasic variation, but with unequal phases. The point of origin of the contraction cannot, in the present state of our knowledge, be stated definitely. It is an experimental fact,[11] that extrasystoles evoked by either mechanical or electrical stimulation of points on the surface of the ventricles are attended with an electrical complex similar in its main features to the one figured. The direction of the first phase and the details of the form vary with the exact location of the point stimulated, and with the leads.

We may consider it established with a fair degree of probability that such contractions start either in the muscular mass of the ventricles themselves, or in some of the terminal branches of the bundle tissue. Those who lean to the theory that the initiation of a contraction is a peculiar function of the remains of the primitive cardiac tube will prefer the latter view, though there seems to be no valid reason to exclude the possibility of the initiation of a contraction by any part of the muscle.

At all events, it is evident that the path of propagation of such a contraction wave through the ventricles cannot possibly approximate the normal. From the form of the electrocardiogram it appears that the contraction wave travels over the muscle mass in much the same way as contraction waves pass over portions of skeletal muscle. Instead of a complex coördinated activity of nu-

[10] Kraus and Nicolai, Ueber das Elektrokardiogramm unter normalen und pathologischen Verhältnissen, Berl. klin. Woch., 1907, Nos. 25 and 26; Das Elektrokardiogramm des gesunden und kranken Menschen, Leipzig, 1910, S. 143.

[11] Ueber die functionelle Solidarität der beiden Herzhälften, Deut. med. Woch., 1908, No. 1, S. 1.

merous parts of the ventricle simultaneously, we have here a spread of the wave from point to point by contiguity. This view is further supported by the increased magnitude of the electromotive forces, indicative of the fact that there is less neutralization of the electrical effect by simultaneous waves passing in the opposite direction. The fact that the two limbs of the diphasic variation are unequal is doubtless to be referred to the fact that while we are here dealing with a comparatively simple contraction wave spreading from a single point, it is spreading through a complex muscle with the result that the changes in potential of the whole surface of the heart are not quite symmetrical during the early and later stages of the systole.

The well-known fact that an extrasystole of the ventricle is usually almost ineffective in propelling blood has been generally ascribed to the fact that it occurs soon after a normal systole, at a time when the heart is presumed to be nearly empty.

The volume curve of the ventricles, obtained with one of the various forms of cardiometer,[12] shows that ventricular filling begins so soon after the completion of systole as to produce a smooth curve without break, and that the filling occupies about the same length of time as the emptying. Throughout more than half the diastolic period with normal pulse frequency the ventricles are full, except for the insignificant amount which the auricular systole will add. At the time of occurrence of the extrasystoles there must be a very considerable amount of blood in the ventricular cavities.

We desire to suggest the view that the ineffectiveness of such systoles is due not so much to lack of blood to be propelled, or of energy to propel it, as to the fact that the energy is misdirected; the fact, clearly shown by the electrocardiogram, that we are dealing with an incoördinate contraction, a temporary ventricular ataxia. This suggests an explanntion of the magnitude of the enormous jugular regurgitant wave which sometimes accompanies extrasystoles in cases of tricuspid insufficiency. Such a case has been described by one of the writers.[13]

It is characteristic of ventricular extrasystoles that they are followed by a compensatory pause of such length that the total duration of the last preceding normal cycle and the extra beat with the succeeding pause is very nearly equal to the time of two normal cycles. This is a consequence of the dependence of the normal rhythm of the ventricles on the auricular rate. The auricular beat following an extrasystole finds the ventricle refractory. The next auricular beat occurs after the usual interval, and the ventricle remains quiescent until it receives another stimulus from the auricle. The nearer

[12] Henderson, The Volume Curve of the Ventricles of the Mammalian Heart, and the Significance of this Curve in Respect to the Mechanics of the Heart Beat and the Filling of the Ventricles, Amer. Jour. Phys., 1906, xvi, No. 3.

[13] James, A Clinical Study of Some Arrhythmias of the Heart, Amer. Jour. Med. Sci., 1908, cxxxvi, 469.

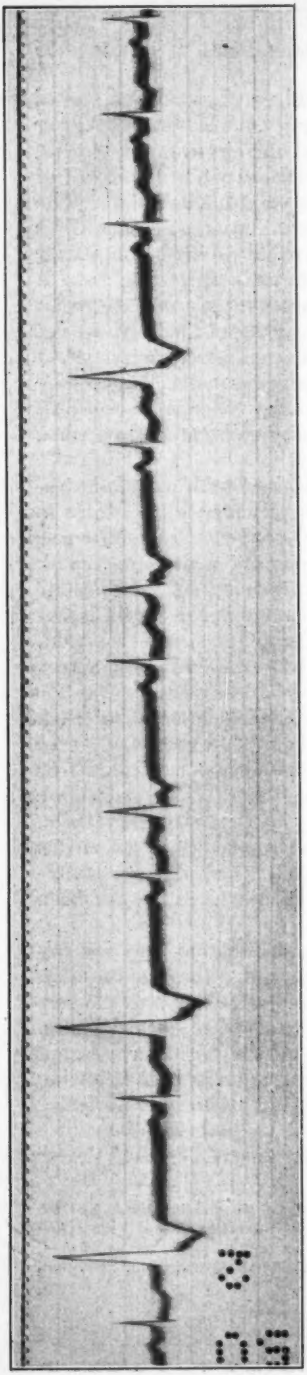

Fig. 7.—Pulsus bigeminus.

the extrasystole occurs to the time of a normal beat, the shorter will be the compensatory pause. If an extrasystole of the ventricle were to occur at the same time as the auricular contraction, the pause following would be longer than a normal diastole by about the length of time which normally elapses between the auricular and the ventricular systole—that is, about one-tenth of a second.

Fig. 7 is from a patient with bigeminal pulse, each alternate beat being a ventricular extrasystole until the last beats of the record, where the normal rhythm was resumed. It will be observed that the first two and fifth extrasystoles have been attended with unusually large differences of potential. From the normal beats at the end of the record it may be seen that the auricular rhythm is not quite regular. If one measures the time between the middle two of these auricular systoles it will be found to coincide exactly with the time which elapsed between each of the very prominent extrasystoles and the last preceding auricular systole.

The electrocardiogram of the fourth extrasystole shown in Fig. 7 presents a small, upward-directed wave interpolated between the two phases of the diphasic curve. The time interval between the last preceding P wave and this small notch is almost exactly the same as that between the first and second P waves of the normal beats at the end of the record. In the case of the extrasystoles which present the extremely large electromotive forces, the thought suggests itself that the auricle has been in contraction at the same time and summed its effect with that of the ventricle.

In the case of the interpolated notch, in the fourth extrasystole, there seems to be considerable reason for presuming that it was caused by auricular activity.

Whether the height of the three large curves was increased by auricular activity occurring at the time of the ventricular contraction seems less clear. The normal P waves have a height of but 2 or 3 mm., while the first curve of the diphasic variation is from 4 to 6 mm. higher than the first curve of the smaller ones. The second, or downward-directed phase of the three large curves, extends 6 mm. below the zero line, while that of the smaller curves extends but 2 or 3 mm. below. This might be accounted for by partial neutralization by simultaneously occurring P waves. The fact that the pauses following the large atypical curves is of about the same duration as that following the smaller ones seems to speak against the supposition that the large curves are due to summation, as does also the fact that the time intervening between the preceding normal beat and the extrasystole is very nearly the same in all cases. Possibly the difference in character of the electrocardiograms of the extrasystoles is merely an expression of the fact that they have arisen from different parts of the ventricle.

THE COMPLETELY IRREGULAR HEART. During the last few years interest in the study of anomalous varieties of heart action has centred on a form of irregularity now familiar to every clinician as a distinct type. This type of arrhythmia has been described under several names, corresponding to a number of theories which have been advanced as to its origin.

Following MacKenzie's hypothesis, the term "nodal rhythm" has been largely applied to it in this country and in England. In Germany, following Hering, it has been designated the pulsus irregularis perpetuus, though it has been established that cases occasionally occur in which the arrhythmia is not "perpetual." Other names for the same condition are "completely irregular" and "absolutely irregular" pulse.

The literature of the subject has attained formidable proportions, and only that portion of it will be referred to which is particularly relevant to the present discussion.

The leading characteristic of this complete irregularity, as determined from tracings of the arterial and venous pulses, is the absence from the venous curve of any evidence of auricular contraction, the waves of the venous pulse occurring in synchronism with the ventricular systole.

MacKenzie[14] originally advanced the view that these cases are the result of auricular paralysis, and considered that, in the absence of auricular contraction, the rhythm is set by the ventricles. Subsequently, the finding at autopsy in some of his cases that the auricles were the seat of hypertrophy led him to modify his views and assume a simultaneous contraction of the auricles and ventricles. To

[14] The Inception of the Rhythm of the Heart by the Ventricles as the Cause of Continuous Irregularity, Brit. Med. Jour., 1904, i, 529.

account for such a simultaneous contraction he assumed as the site of origin of the rhythm the tissue situate in the region between auricles and ventricles, and eventually assumed the node of Tawara[15] as the most probable site of origin of a stimulus which he conceived as passing upward to the auricle and downward to the ventricle.

Hewlett[16] and Hering[17] have both called attention to the difficulty of reconciling MacKenzie's view of an infra-auricular origin of the rhythm with the well-known fact that when, in cases of complete heart block, an independent ventricular rhythm is known to exist, this rhythm is not only regular, but very much slower than the rate usually observed in complete irregularity. In the article above referred to, Hering recognizes that the weight of evidence is in favor of a supraventricular origin of the rhythm. He concludes that the particular supraventricular portion of the heart in which the stimulation arises is as impossible to determine as is the cause of the irregularity itself. In a further communication, Hering[18] notes the absence of the auricular (P) wave in the electrocardiogram of complete irregularity. Having convinced himself by animal experimentation that contractions of the auricle, so feeble as to be all but indistinguishable by mechanical means, give, nevertheless, a distinct auricular electrocardiogram, and also that the auricular wave is still to be distinguished from the initial wave of the ventricular electrocardiogram when the two chambers have contracted within one-fiftieth of a second of each other, he is led to the conclusion that in complete irregularity the auricular contraction occurs at exactly the same instant as the ventricular, or else that it fails altogether. In a still more recent paper[19] he commits himself to the view that the theory of complete standstill of the auricle is the one best supported by the evidence. In brief, he refers the origin of the stimulus either to the regions of the mouths of the great veins or the muscle of the auricle, but supposes that the production or transmission of the wave of excitation by the auricle is unattended by contraction of that chamber.

This is a most novel and ingenious conception. That in a condition of depression of the function of contractility the function of conduction or of stimulus production may still be preserved seems theoretically possible. That conduction of a stimulus can take place without giving evidence of an attendant action current in a galvanometer adjusted to the sensitiveness suitable for the recording of the electrocardiogram is evident from the fact that in the

[15] MacKenzie, the Interpretation of the Pulsations in the Jugular Veins, Amer. Jour. Med. Sci., 1907, cxxxiv, 12 to 34.

[16] The Interpretation of the Positive Venous Pulse, Jour. Med. Res., 1907, xvii, No. 1.

[17] Ueber den Pulsus irregularis perpetuus, Deut. Archiv f. klin. Med., 1908, xciv, 191.

[18] Das Elektrokardiogramm des Irregularis perpetuus, Deut. Archiv f. klin. Med., 1908, xciv, 205.

[19] Ueber das Fehlen der Vorhofzacke beim Irregularis perpetuus, Münch. med. Woch., 1909, xlviii, 2483.

normal electocardiogram the string remains at rest during the time of passage of the excitation wave through the auriculoventricular bundle. In our estimation, however, the weak point in this theory is its failure to account for the irregularity which is really the crux of the situation. That any single region of the cardiac muscle can develop an irregular rhythm seems very unlikely in the light of our knowledge of the physiology of cardiac muscle. The excised and perfused mammalian heart beats with a perfectly regular rhythm; strips cut from the cold-blooded heart beat regularly, and strips of mammalian heart muscle can be made to contract rhythmically, but always with a regular rhythm. Even skeletal muscle placed in a suitable solution of salts can be made to execute rhythmic contractions, and these are regular.

By exclusion we are forced to seek an explanation along other lines than those thus far indicated.

In January, 1907, Cushny and Edmunds[20] reported a case of paroxysmal irregularity of the heart, which inspection of the arterial pulse tracings shows to have been of the completely irregular type during the paroxysms. Having previously observed a very irregular action of the ventricles in animals in which auricular fibrillation occurred during the course of operative procedures, they were led to make a comparative study of the pulse in the two conditions, and offer the suggestion that the condition of their patient may have been due to paroxysms of auricular fibrillation.

Within the last year, Rothberger and Winterberg[21] have published electrocardiograms obtained from animals during auricular fibrillation experimentally produced. Their electrical records exhibit, in addition to the characteristic irregularity of the rhythm, a peculiar undulatory movement of the string shadow during the diastolic intervals. There is no trace of the normal auricular action current (P). Their electrocardiograms, taken from clinical cases of "Pulsus irregularis perpetuus," present in all respects a most striking resemblance to the experimental curves.

Lewis,[22] of London, has published similar experimental and clinical records, and in his clinical cases, by the use of special electrodes applied directly to the chest wall, he has succeeded in obtaining an especially clear record of the diastolic undulations. As long ago as 1906, Einthoven[23] published electrocardiograms from two cases of this type of irregularity, both of which records exhibit the characteristic diastolic undulations and absence of P-waves.

Hering's electrocardiograms also exhibit the undulations, though

[20] Paroxysmal Irregularity of the Heart and Auricular Fibrillation, AMER. JOUR. MED. SCI., 1907, cxxxiii, 66.

[21] Ueber das Elektrokardiogramm bei Flimmern der Vorhöfe, Pflüger's Archiv, 1910, cxxxi, 387; Vorhofflimmern und Arrhythmia perpetua, Wien. klin. Woch., 1909, xvii, No. 24.

[22] Auricular Fibrillation and Its Relationship to Clinical Irregularity of the Heart, 1910, i, 306 to 372.

[23] Le Télécardiogramme, loc. cit., p. 145, Fig. 17, and p. 157, Fig. 31.

they are rendered more or less obscure by the superposition of oscillations of a more rapid period, probably due, as he suggests, to tension of skeletal muscles.

The diastolic undulations which replace the P wave in complete irregularity are irregular in rate, but decidedly slow as compared with the action currents of voluntary muscle. The latter, as has been shown by Piper,[24] occur at a rate of from 47 to 50 per second, while in our records the undulations of complete irregularity have a frequency of from 7 to 15 per second, so that they can frequently be observed directly during the taking of the record. On account of the proximity of the hospital to electric car lines, we have been unable to eliminate mechanical vibration entirely from our records; but by taking control curves with every record we have convinced ourselves that the period of vibration of the building is always shorter than that of the undulations in question and longer than that of the voluntary muscle action currents. During the last six months we have taken upward of 300 records, and among all these records nothing corresponding to the undulations of complete irregularity has been found in any case from which the irregularity was absent.

Lewis has called attention to the fact that the height of the undulations is often as great as that of a normal P wave. Hering[25] reports that he has observed very large differences of potential to result from ventricular fibrillation. Kraus and Nicolai[26] have published the electrocardiogram of a dog in agonal ventricular fibrillation.

Fig. 8 is the electrocardiogram of a dog taken during ventricular fibrillation. The maximum excursions are of greater height than were the R waves of the normal electrocardiogram in this animal. The magnitude of the electromotive forces is doubtless to be explained in the same manner as was suggested in the discussion of ventricular extrasystoles.

Rothberger and Winterberg have indicated their belief that the completely irregular pulse is the result of auricular fibrillation. Lewis has definitely stated his belief that such is the case.

The most important arguments in favor of this explanation may be summarized as follows: It accounts for the rapidity of the rhythm by assigning its origin to the auricles. It accounts for the irregularity. Impulses originate from many points in the auricular musculature, and there may be as many rhythms as there are points of origin. Not every impulse will affect the ventricle, but the chance of its securing a regular rhythm from its delirious pacemaker is very slight. Finally, the correspondence between the clinical condition and the experimental seems to be complete in every feature.

[24] Ueber den willkürlichen Muskeltetanus, Pflüger's Archiv, 1907, cxix, 301; Neue Versuche über den willkürlichen Tetanus der quergestreiften Muskeln, Ztschr. f. Biol., vol. l, 393 to 420.

[25] Loc. cit.

[26] Das Elektrokardiogramm des gesunden und kranken Menschen, S. 144.

In the article cited, Hering[27] states that while the hypothesis of fibrillation explains the facts in complete irregularity better, he considers his assumption of auricular standstill to be better supported. The objections which he raises have been answered seriatim by Rothberger and Winterberg,[28] and we must refer to the original articles for the discussion.

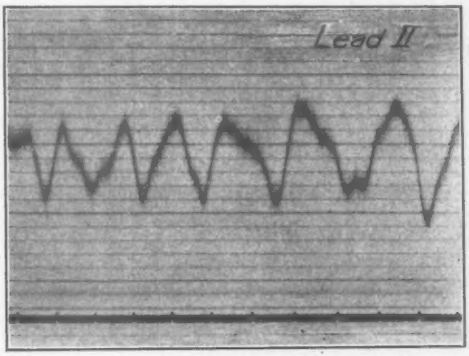

FIG. 8.—Action current of ventricular fibrillation in a dog's heart.

Upon one objection we wish to comment. Hering[29] makes the statement that to have the diagnosis of fibrillation in complete irregularity accepted, it must first be proved that the auricles can go on fibrillating for weeks and months, and even for years, as complete irregularity is known to do. He cites Hewlett as having raised the same objection. To this we reply that no evidence is at hand to indicate that fibrillation of the auricles may not persist indefinitely. Once established in the ventricles, fibrillation tends to persist until death, which must shortly ensue through failure of the circulation. Auricular fibrillation is far from crippling the circulation. Blood pressure remains good, and animals may be kept alive for hours with auricles fibrillating. When auricular fibrillation is produced experimentally there is at first a tendency for the auricle to resume the normal rhythm on cessation of the faradic stimulation used to provoke delirium. The oftener the auricle is thrown into fibrillation the longer does the condition persist after cessation of stimulation; at least, that has been our experience. We do not know as yet what underlying factors induce the clinical condition which we believe to be auricular fibrillation, but it seems probable that it will be found to be a degenerative process involving the auricular muscu-

[27] Loc. cit.
[28] Ueber den Pulsus irregularis perpetuus, Wien. klin. Woch., 1909, No. 51, 1792.
[29] Loc. cit.

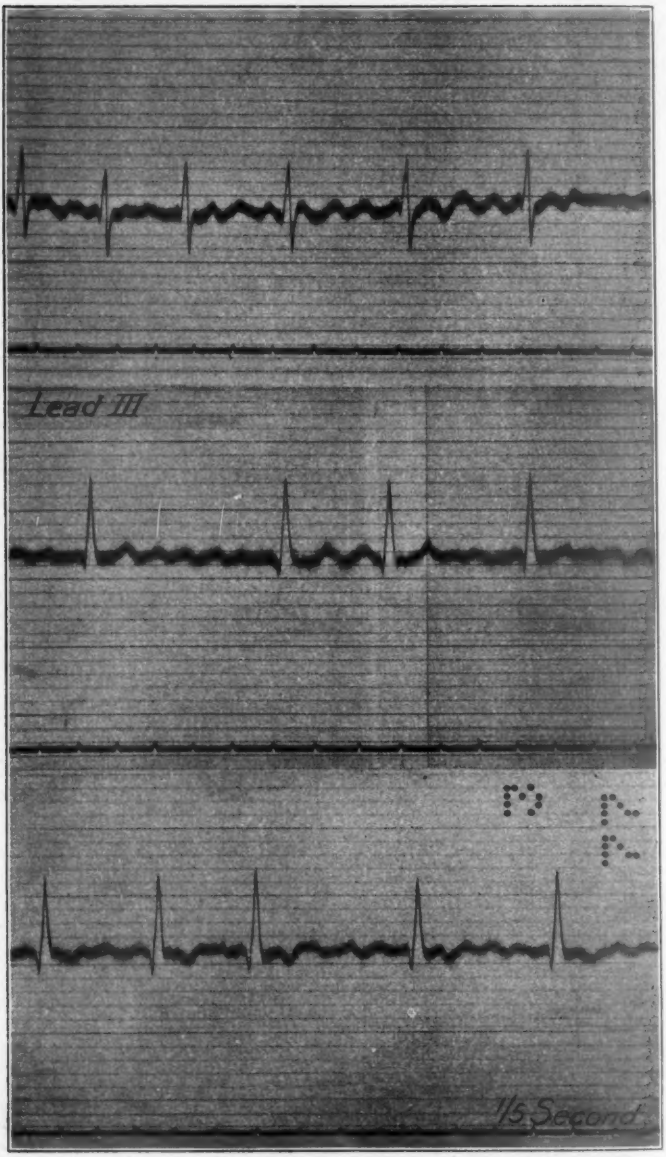

FIG. 9.—Auricular fibrillation in complete irregularity.

lature. At all events, if it be found to be a permanent organic change, there is every reason to suppose that it will tend to perpetuate the condition it has produced. The occasional reversions to the normal rhythm in cases in which the incidence of the complete irregularity has been recent, and the tendency which Hering has noted for this rhythm to become eventually permanent, seem to furnish an additional argument in favor of the fibrillation hypothesis.

Since we have been able to apply the galvanometer to the study of these cases, we have had opportunity to secure records from 16 patients who presented the completely irregular type of pulse. Fig. 9 illustrates typical curves from such cases. It will be seen that there is some variation in the heights of the peaks R and T, and it can be determined that this variation is not conditioned on the respiratory rhythm.

In some cases there is deformation of T, and in some this wave is difficult to distinguish. These characters are to be noticed in the

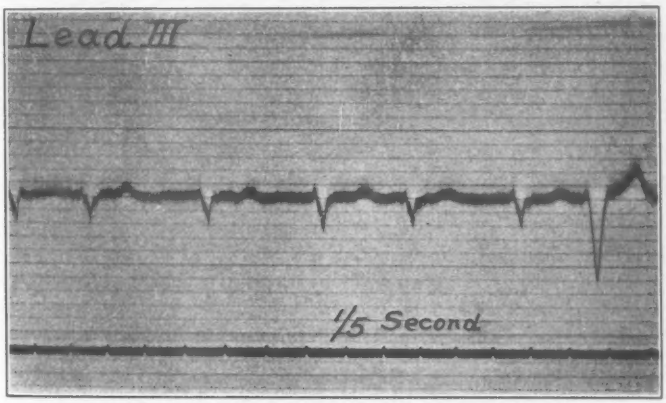

FIG. 10.—Ventricular ectopic beat in complete irregularity.

curves which other observers have published. Lewis ascribes the variations in R and T to reinforcement and interferences between the electromotive forces of the ventricles and the auricles, the latter being in continual activity. Fig. 10 shows, in addition to the usual picture of auricular fibrillation, ectopic beats originating in the ventricle. Lewis has reported a similar case. He refers to the atypical ventricular beat as an "extrasystole." We suggest that, in view of the fact that no regular auricular rhythm exists in these cases, the avoidance of the term "extrasystole" altogether in this connection would tend to greater clearness of thought.

Though there is sometimes great embarrassment of the circulation in cases of complete irregularity, we do not invariably find

great crippling of the circulation associated with this condition. Fig. 11 is an electrocardiogram which presents the characteristic irregularity, and in which the diastolic undulations are especially well marked. For several months prior to the taking of this record the patient's pulse was known to be irregular, and sometimes it has been very rapid—as high as 200 per minute. He has had one attack of dyspnœa. He was perfectly comfortable at the time this record was taken, and at the time of writing he seems, aside from the irregularity of his heart, to be in most excellent health. He has recently been able to enjoy the rather vigorous exercise of an extended fishing trip. The case is of interest on account of the lack of disagreeable symptoms and the almost complete freedom from circulatory disability.

As before mentioned, the underlying cause of the onset of fibrillation is unknown.

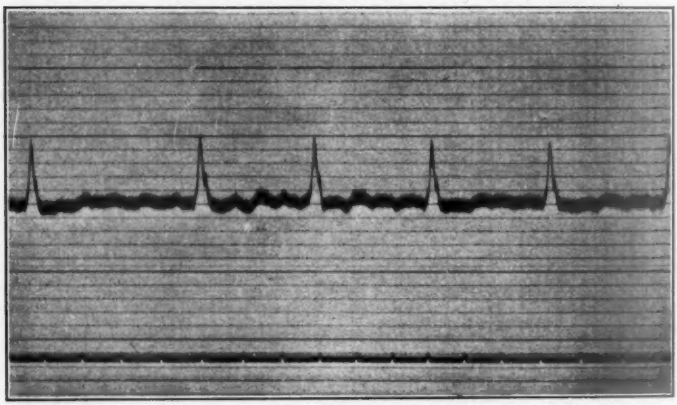

FIG. 11.—Auricular fibrillations in complete irregularity, from a patient in whom the condition produces no disability.

Lewis, in his recent communication, has called attention to the fact that in the greater number of instances in which histological study of the heart in cases of complete irregularity has been undertaken, attention has been directed principally to the condition of the nodes and bundle. It is very much to be desired that in all cases in which complete irregularity has been known to exist, and especially in which it has been possible to secure electrocardiograms, careful histological study should be carried out to ascertain the condition of the entire auricle.

Such a case as the one last described leads one to surmise that the lessened cardiac efficiency observed in many patients with complete irregularity may not be due wholly to the abnormal activity of the

auricle, but that possibly both the auricular fibrillation and the circulatory insufficiency have a common origin in some fundamental anatomical change.

DISTURBANCES OF CONDUCTIVITY. The electrical method is especially well adapted for the study of disturbances of conductivity, on account of the ease with which the auricular and ventricular phases of the electrocardiogram can be distinguished in nearly all of the records.

So far we have had no opportunity to obtain records from a case of complete dissociation.

Fig. 12 is from a patient who was admitted to the hospital with acute cardiac dilatation, and developed a bigeminal pulse after

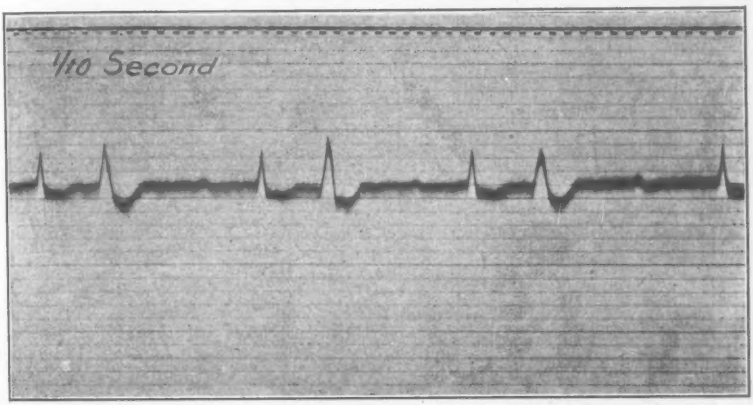

FIG. 12.—Pulsus bigeminus, with disturbed conduction following the administration of digitalis

taking full doses of infusion of digitalis for two days. Aside from the alternation of normal systoles with ventricular extrasystoles, it is noticeable at once that there are very marked variations in the lengths of the P—R intervals, the intervals which represent the time of conduction of the contraction waves from auricle to ventricle.

This effect of digitalis is not uncommon. The patient made a good recovery, and the pulse was normal a few days after this record was taken.

Cases of complete heart block have been reported by Einthoven and others in which the dissociation between auricles and ventricles is clearly distinguishable in the electrocardiograms.

Interesting animal experiments have recently been reported by Eppinger and Rothberger,[30] in which they studied the change in the

[30] Ueber der Folgen der Durchschneidung der Tawara'schen Schenkel des Reizleitungssystem, Zeitsch. f. klin. Med., lxx.

electrocardiogram produced by section of the right and left limbs of the bundle (limbs of Tawara). They obtained striking effects. The most notable features of the change were an enormous increase in the electromotive forces of the ventricular phase of the electrocardiogram and a change from the normal complex to a diphasic variation, closely resembling the electrocardiogram of a ventricular extrasystole. The sounds changed to a gallop rhythm. For more detailed information reference must be made to the original article.

Fig. 13 is from a patient with moderate hypertrophy. The percussion outlines were: left border, extreme left limit, 6.5 cm. to the left of the midsternal line; right border, 3 cm. to the right of the parasternal line. He has suffered with increasing dyspnœa for the last five years. The second aortic sound is accentuated, there are no murmurs, but there is a gallop rhythm.

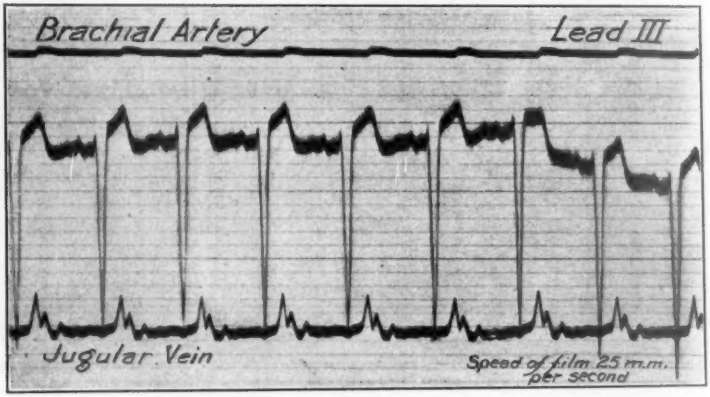

FIG. 13.—Possible lesion of the right limb of the bundle of Tawara.

Fig. 13 is his electrocardiogram obtained with lead III. This record is published on account of the marked similarity between it and the records of the experimental lesions of one limb of the bundle just mentioned.

As Eppinger and Rothberger employed the œsophagus-rectum lead, we have chosen lead III of our case for comparison, as it is in the direction of the long axis of the body and corresponds fairly well with the lead they adopted.

It will be seen that the differences of potential are enormous, and that the ventricular electrocardiogram reminds one strongly of a ventricular extrasystole. Each ventricular electrocardiogram, however, is preceded by a normal P wave. The sensitiveness of the galvanometer in this case was determined before and immediately following the taking of the record, and was, as usual, 1 cm., equal

to 1 millivolt. A downward directed R III, as we have previously mentioned, is uniformly found with left hypertrophy, but this patient presents only a moderate left hypertrophy and considerable right hypertrophy, which, as we have seen, tends to produce an electrocardiogram with strongly upward directed R III.

These several considerations suggest that in this man there is a lesion in the right limb of Tawara. Such a surmise could only be confirmed by postmortem evidence, and we do not wish to have it understood that we feel justified in making a positive diagnosis of this kind at present; but should events prove this diagnosis correct, it indicates one of the ways in which the electrocardiogram may prove helpful in the diagnosis of obscure conditions.

CONCLUSIONS. The large number of inquiries which have reached us regarding the probable future of the string galvanometer as an aid to clinical diagnosis leads us to believe that, in conclusion, a brief consideration of the matter may not be unprofitable.

As an instrument of precision for original study, the string galvanometer leaves little to be desired. The ease with which it may be adjusted to standard sensitiveness, and the rapidity with which the photographic records may be made, presents a striking contrast to the technical difficulties of many physiological methods. Once the apparatus is properly installed, comparatively little skill is required to manipulate it, and this may be readily acquired with practice. In common with all delicate and somewhat complicated physical apparatus, it is liable to occasional derangement, a liability which can be minimized by very careful attention to the original installation. When trouble does occur, it may require a rather intimate knowledge of the physical principles involved to ascertain its nature and make the necessary adjustments.

To those who are interested in the prosecution of original study, and who are able and willing to devote a good deal of time to such work, we can recommend the method as well worth while. It seems probable that its most important field of usefulness, so far as clinical medicine is concerned, will be the clearing up of morbid phenomena now little understood, and that once the explanations have been given, the clinician will no longer need this complicated apparatus to enable him to recognize and understand the conditions it has explained.

Just how much information regarding the effect of treatment in disease of the heart can be obtained by the use of this method cannot as yet be stated, but it seems likely that there is opportunity for fruitful work in that direction. Einthoven has employed the galvanometer in connection with a microphone[31] as a means of obtaining graphic records of heart sounds and murmurs. So far we have been unable to carry on investigations of this nature except late at night,

[31] Die Registrierung der menschlichen Herztöne, mittels des Saitengalvanometers, Pflüger's Archiv, 1907, cxvii, 461.

on account of the noise of traffic in the neighborhood of the hospital. Given a quiet environment, the method is easy of application.

One of the chief merits of the method is that it makes possible the study of cardiac pathology from the functional as well as the anatomical standpoint.

That the galvanometer may prove a great aid in the diagnosis of an occasional obscure case, experience has shown; but considered simply as an aid to diagnosis, its cost and the time requisite to secure the necessary familiarity with its manipulation will preclude its extensive use.

There can be no doubt of the advantage of having the apparatus installed in large medical centres, where it can be used both as a means of diagnosis and for original work as well.

To those who contemplate the use of the apparatus we cannot too strongly recommend that they spare no trouble or expense to have the original installation properly made. While small and comparatively inexpensive models of the string galvanometer are to be had, which serve a useful purpose in special lines of work, they are to be avoided by those who intend to use the instrument for study of the heart. The small instruments with permanent magnets can only be given the requisite sensitiveness by using a very slack string, and this results in a slower movement, similar to that obtained with the capillary electrometer. Curves thus obtained would require mathematical reconstruction to be available. Still more important is the necessity of an optical system with lenses of high aperture, as only by their use can sufficient illumination be secured to insure good photographic results at high rates of film speed. The amount of light which can be utilized depends solely on the optical system, and, as Einthoven has shown, an increase in intensity of the source of light is ineffective after the capacity of the optical system has been reached.

Westerlund[32] has called attention to the fact that the small instruments with electromagnets are unserviceable for critical work, because the relatively small masses of metal are rapidly heated by the current used to excite the magnets. The result is that the sensitiveness of the instrument varies from moment to moment.

The matter of insulation is of the highest importance. We emphasize this especially because one recent writer has commented on the fact that he secures satisfactory results without much attention to careful insulation. This may be the case for a long time, but sooner or later, often at the time of a critical observation, the lack of care will be regretted. Einthoven has always insisted on the necessity of careful insulation, and our experience bears out the wisdom of his contention. It may be interesting to know that we

[32] Ueber einige Beobachtungen mit einem von Edelmann gelieferten kleinen Modell des Einthoven'schen Saitengalvanometers, Skand. Arch. f. Physiol., 1909, xxii, 281.

suffered the greatest annoyance on a damp day from rhythmic deflections of the string, for which we could account only by the assumption that they were telegraphic code. These signals persisted after disconnecting all wires leading away from the apparatus table, and even after disconnecting one end of the string. We found that our table, painted a dead black with carbon paint, was acting as a large capacity and discharging itself into the string. Proper attention to the insulation promptly corrected the difficulty. The source of the rhythmic variations we assumed to be electric waves from nearby wireless stations. We report this to illustrate a source of trouble which may be easily avoided by proper attention to the installation.

Finally, we have already, in the first part of this communication, urged the advisability of the adoption of uniform methods of work by all who engage in the study of electrocardiograms. The subject at best is beset with difficulty, and if each worker adopts a nomenclature of his own it renders far greater the labor of understanding his communications. Uniformity of nomenclature, uniformity regarding sensitiveness of the instrument, and the taking of all three leads will do much to prevent confusion.

IPECAC IN THE TREATMENT OF INTESTINAL AMŒBIASIS.[1]

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The temporary cessation of dysentery in amœbic infections has been an easy thing to bring about in the majority of cases, but the eradication of the infection was long our despair. The former could generally be accomplished by merely keeping the patient at rest in bed on a suitable diet; in an attempt to accomplish the latter, we treated our patients during four years with copious enemas of normal salt solution, quinine solutions in varying strengths up to 1 to 250, thymol solutions up to a strength of 1 to 500, and quinine and thymol combined in solutions of 1 to 500, and 1 to 1000, respectively. We treated many patients with intestinal amœbiasis both with and without dysentery, and some for prolonged periods of time. Among those with dysentery we never eradicated an infection and amœbæ always reappeared within a few days after treatment was discon-

[1] Read at a meeting of the American Society of Tropical Medicine, St. Louis, June 11, 1910.

tinued, and were present when the patients left the hospital. Among the patients without dysentery we cured the infection of one with 1 to 500 quinine enemas, and of two with enemas of quinine and thymol, 1 to 500 and 1 to 1000 combined.

We have used the bismuth treatment advocated by Deeks and Shaw[2] without success, but we did not give this treatment a thorough test. However, within a short time following the presentation of the paper by Deeks and Shaw to the Medical Society of the Canal Zone, we admitted to Colon Hospital five patients with recurrences of dysentery, for which they said that they had been treated with bismuth at Ancon Hospital. These patients all had amœbæ in their stools. We cannot feel, therefore, that the conclusions of Deeks and Shaw are justified, and experience has taught us that it is very difficult in Panama to follow one's patients and to make repeated examinations of stools.

Ipecac Treatment. On account of the recommendation of English physicians, especially Manson,[3] ipecac also was tried, but in an unenthusiastic manner. Without the salol- or keratin-coated pills the doses given were necessarily small, vomiting was frequent, and the ipecac that was retained had no effect upon the amœbæ. We were skeptical about it, as about bismuth, chiefly because of our knowledge of the pathological conditions with which we had to cope, for it was to us inconceivable that any drug given by the mouth could reach the colon in sufficient amount to be parasiticidal to amœbæ buried deep in the gut wall or protected in ulcers by a thick layer of tenacious, necrotic material. Local applications and surgical interference held out, to our minds, the greatest hope of success in the treatment of this *bête noir* of tropical and subtropical diseases.

However, after Dock's[4] communication on the subject, and after one of us had talked with him and with Boggs, of the Johns Hopkins Hospital, who also had used ipecac successfully, we determined to give the drug a thorough trial. We present our cases in detail at the end of the paper. They have been grouped according to the presence or absence of dysentery, according to the length of time that we were able to follow them, and according to the success or failure of the treatment. By "dysentery," we mean the condition manifested by abdominal pain, tenesmus, diarrhœa, and stools containing blood, pus, and mucus.

Eight cases of amœbiasis with dysentery were followed for six weeks to five and one-half months, with repeated examinations of stools for amœbæ. All were successfully treated with ipecac. Case III is the most striking and convincing case that we have had. Three cases (IX, X, and XI) of amœbiasis with dysentery were successfully treated also, but were followed less than six weeks. Three

[2] Medical Record, November 13, 1910.
[3] Tropical Diseases.
[4] New York Med. Jour., July 10, 1909.

cases (XII, XIII, and XIV) of amœbiasis without dysentery were successfully treated and followed two to five months. In four cases XV, XVI, XVII, and XVIII) of amœbiasis without dysentery, the ipecac treatment failed. The four unsuccessful cases all belonged to the group of amœbic infections without dysentery; one patient was so susceptible to irritation by ipecac that he could not be thoroughly treated; three were not "bed patients," and the diet was not carefully regulated; none could be considered thoroughly treated. The amœbæ of one of these patients (Case XVI) corresponded to the description of Entamœba histolytica;[5] with Wright's stain the endoplasm took a pale blue stain, the ectoplasm a darker blue, the protoplasm was vacuolated, inclusions were present, the nucleus was ill-defined, and the chromatin scattered; in the fresh specimen the amœbæ were large, active, vacuolated, and the ectoplasm was distinct. The amœbæ of two of the patients (Cases XV and XVII) were small, sluggish, and the ectoplasm was not well defined; the endoplasm stained a deeper blue than that of Entamœba histolytica, the ectoplasm a very dark blue, the chromatin was scattered and more abundant, and the nucleus ill-defined. The amœbæ of the fourth patient (Case XVIII) seemed to be Entamœba histolytica in the fresh specimen; in the stained specimen, however, they resembled those of Cases XV and XVII, but were much larger.

It is quite probable that different strains of amœbæ will prove to vary in their susceptibility to ipecac. We found this to be the case, apparently, in connection with quinine. The motility of some strains of amœbæ was readily checked by a 1 to 1000 solution of quinine sulphate, and the amœbæ assumed a granular, less refractile, degenerated appearance in from twelve to fifteen minutes. On the other hand, we have experimented with a strain, the amœbæ of which, in fresh stools mixed with quinine so as to make a 1 to 250 solution, retained their motility six to nine minutes; and in 1 to 500 solutions, fifteen minutes. It seems possible, therefore, that a certain number of patients may harbor amœbæ that have the power to resist ipecac, and that a certain number of failures may be expected.

Preparation of Ipecac. Salol-coated pills were used in all the cases except one (Case VI), in which ipecac in capsules was used. Our pills were obtained from one of the reliable drug houses in the United States. The first lot of pills were covered very thinly with salol, and vomiting not infrequently followed, usually three to eight hours after ingestion of the pills. Occasionally, pills were found in the vomitus. In one instance we filtered the vomitus, which had a strong acid reaction, and immersed several of the pills in it. The salol coat was gradually dissolved, and within an hour or two the pills were disintegrated. When Simon's[6] article, in which he suggested a salol coat $\frac{1}{8}$ inch thick, appeared, we compromised and

[5] Jour. Infec. Dis., 1908, v, No. 3. [6] Jour. Amer. Med. Assoc., 1909, liii, 1526.

ordered pills with a salol coat $\frac{1}{16}$ inch thick. Vomiting has not occurred with these pills, but we have found that they sometimes pass through the alimentary canal before the salol coat is dissolved.[7] We must be careful, therefore, on the one hand, not to have a coat that is too thin, and, on the other hand, to have it thin enough to be readily dissolved in the intestine. The $\frac{1}{16}$ inch coat of the pills that we have used is certainly thick enough, and perhaps slightly too thick.

The Dosage and Administration of Ipecac. We have tried several systems of dosage and administration. Two patients (Cases III and IX) were given 80 grains to begin with at 9 P.M., and the dose was reduced 5 grains each night until a dose of 10 grains was reached. One patient (Case VI) was treated successfully with ipecac in capsules beginning with only 40 grains. The ipecac was preceded by an opiate. Three patients (Cases I, II, and XII) were given 120 grains during twenty-four hours, and amœbæ were never found afterward, excepting one five months later in Case XII. This is a rapid method, but we do not feel that it is a sure one. It was attempted in Case XVI, and failed, and, moreover, excited a severe dysentery. In Case VIII doses of from 40 to 80 grains were given at intervals of from two to seven days.

We agree with those who advocate beginning with 60 grains, or, better, 80 grains, of ipecac, and reducing the dose gradually until a dose of 10 grains is reached. As a rule, it is unnecessary to continue the treatment longer, and usually advisable not to do so, for the small doses may serve only to keep up a catarrhal condition of the bowel, already excited by the large doses. Such a catarrhal condition with mild diarrhœa seems to be commonly produced.

DIET IN THE TREATMENT. Food plays an important part in the treatment The pills may be delayed in the stomach by solid food or by milk curds, until the salol coating is coroded and vomiting is excited. We have seen milk curds containing disintegrated ipecac pills vomited several hours after ingestion. One patient (Case XII) took 60 grains at night three hours after eating a light dinner, 40 grains the next morning immediately after a light breakfast of coffee and toast, and 20 grains at noon after luncheon at which some asparagus was eaten. There was no nausea or discomfort until two hours after the luncheon, when an extraordinary pulpy gelatinous mass of asparagus containing disintegrated ipecac pills was vomited. Furthermore, the residue from too much food must certainly serve to embed and scatter the ipecac so that it cannot come into thorough contact with the gut wall. While we believe that many infections may be eradicated without stringent dieting, still in all cases no solid food or milk should be given for

[7] In the discussion of the paper Simon stated that the salol coat of pills freshly prepared with fused salol was more easily dissolved than the salol coat of the pills that we used. The freshly prepared pills are probably more reliable.

at least six hours before the ipecac, and no food of any kind for three hours before. To insure success, the patient should be kept in bed on liquid diet, milk should not be given during the six hours preceding ipecac, and no other liquids for three hours. We make it a practice to keep the patient lying on his right side because of the possibility that gravity may help the progress of the pills into the pyloric end of the stomach. We have begun now to flush the colon with normal salt solution during the afternoon. The pills are given about 8 or 9 P.M.

SUMMARY. 1. We despaired of success after four years of experience in attempting to eradicate intestinal amœbiasis by means of rest, dieting, and lavage of the colon. We used copious enemas of normal salt solution, quinine, thymol, and quinine and thymol combined.

2. We have apparently cured 14 amœbic infections with ipecac: 8 with dysentery, followed six weeks to five and one-half months with repeated examinations for amœbæ; 3 with dysentery, followed less than six weeks; 3 without dysentery, followed two to five months. We have failed to eradicate the infection in 4 cases, but these were not thoroughly treated.

3. The thickness of the salol coat of the ipecac pills must be carefully regulated so as to prevent vomiting on the one hand, and on the other, the passage of intact pills through the intestinal canal.

4. Probably the best dosage and method of administration is to begin with 60 or 80 grains at bedtime and decrease the dose 5 grains daily until a dose of 10 grains is reached. Rapid cures may sometimes be effected by giving 40 grains three times during twenty-four hours.

4. The patient should be at rest in bed and on liquid diet; no solid food or milk should be given for at least six hours previous to the ipecac, and no liquids for three hours previous. No opiate is necessary.

5. Our experience indicates that a large proportion of amœbic infections can be eradicated by ipecac treatment. It is far superior to any treatment that we have hitherto tested, and it should always be given a thorough trial before surgical treatment is attempted.

REPORT OF CASES.

A. CASES OF INTESTINAL AMŒBIASIS WITH DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED SIX WEEKS TO FIVE AND ONE-HALF MONTHS AFTERWARD.

CASE I.—No. 20725, white, American; on the Isthmus six months; admitted November 2, 1909.

History. Dysentery in the Philippines in 1909, lasting six weeks, on account of which the patient was sent home. He recovered

and did not have dysentery again until he came to the Isthmus. About one month ago he began to have diarrhœa, tenesmus, and bloody stools, for which he received bismuth treatment at Ancon Hospital. On admission to Colon Hospital, the patient had estivo-autumnal malarial fever, diarrhœa, tenesmus, and bloody stools. Microscopic examination of the stools showed large, active amœbæ. Copious enemas of normal salt solution were given twice daily for thirteen days, and then enemas of 1 to 1000 quinine solution twice daily for thirteen days. At the end of this time, November 27, amœbæ were still present in the stool, though the dysentery had ceased.

Treatment. On November 29 the patient was given 120 grains of ipecac in three doses of 40 grains each, morning, noon, and night.

Subsequent History. The treatment was followed by a recurrence of malarial fever, November 30, and by a sharp attack of diarrhœa with bloody stools lasting about one week. There was no further intestinal trouble, however. The patient was last seen in May, 1910, more than five months after treatment.

Stool Examination. During the dysenteric attack following ipecac the stools were negative for amœbæ, and none were found on subsequent examinations. Examinations were made December 3 and 13, 1909, January 29, February 7, 12, 17, and 20, March 26, April 7, April 13, 1910.

Case II.—No. 20994, white, American; on the Isthmus eighteen months; admitted November 17, 1909.

History. Dysentery about eleven months before admission; treated at Santo Tomas Hospital, in Panama, for six or seven weeks; was better for one week, but then the dysentery recurred. Three weeks after discharge from Santo Tomas (eight or nine months before present admission), he entered Ancon Hospital and received bismuth treatment for six weeks. Dysentery has persisted intermittently since discharge from Ancon. Entered Colon Hospital first on September 16, 1909; the diagnosis made was amœbic dysentery; amœbæ were present in the stools; treated until November 14 (nearly two months) with enemas twice daily of normal salt solution, alternating with enemas twice daily of 1 to 1000 quinine solution. Dysentery improved, but amœbæ were still present on discharge. Three days after discharge the patient was readmitted (present admission) to Colon Hospital with dysentery associated with large, active amœbæ.

Treatment. Ipecac in 5 grain salol-coated pills, 120 grains in three doses of 40 grains each, was given November 4, 1909.

Subsequent History. The patient vomited one hour and three hours after the first dose, and three pills were ejected. No further vomiting. A slight diarrhœa for one day followed the ipecac, and then the stools became formed and movements normal.

Stool Examination. The patient was under observation until May, 1910 (five months), and there was no recurrence of dysentery. All stool examinations made after the ipecac treatment were negative for amœbæ. Examinations were made November 26, December 10, 12, 1909, March 22, April 17, April 29, 1910.

CASE III.—No. 21743, white, American; on the Isthmus three and one-half years; admitted January 8, 1910.

History. Dysentery three years ago with abscess of liver; operated on at Ancon Hospital with good recovery. Four attacks of dysentery since: (1) February, 1909, in Ancon Hospital, eight days, treated with bismuth; no irrigations; (2) June, 1909, Colon Hospital, nineteen days, amœbæ found, no diarrhœa, but severe burning sensation in lower abdomen; treated with copious enemas of normal salt solution twice daily; improved; (3) July, 1909, Colon Hospital four months, slight diarrhœa on admission, intense continuous burning sensation in lower abdomen, numerous amœbæ in stools; appendicostomy, July 19; cecum and ascending colon were found to be enormously thickened, purple in color, extensively diseased; irrigations through appendix twice daily for eight weeks with 1 to 4000 and 1 to 3000 quinine solution, then no irrigations for about eight weeks; improvement; (4) January, 1910 (present admission), two months after last discharge, nine to thirty movements daily, tenesmus, blood, mucus, intense pain.

Stool Examination. Mucus, blood, pus, enormous numbers of large, active amœbæ, distinct ectoplasm, vacuolated; many with red blood-corpuscles engulfed; stain with Wright's stain like amœbæ of "Cochin China Dysentery;"[8] that is, they take a darker blue than Entamœba histolytica, and contain an enormous quantity of chromatin diffusely scattered; no discernible nucleus.

Treatment. Ipecac, 80 grains at 9 P.M., January 9. The dose was decreased 5 grains each night until reduced to 5 grains January 24. Patient vomited twice, six and seven hours after the first dose and twice, four and ten hours after the third dose. The patient was discharged February 6, about one month after admission.

Subsequent History. While in the hospital the number of stools per day decreased to two or three; they were semisolid and contained mucus. By February 20 the stools had become normal. Patient was under observation four and one-half months after treatment.

Examinations for amœbæ were as follows:

January 10. Ipecac begun January 9. Amœbæ found in only one of seven preparations examined.

January 11. A few amœbæ found without difficulty.

January 12. Three preparations examined, many amœba-like bodies found, but no motile ones seen.

[8] Annales de l'institute Pasteur, March, 1909, t. xxiii, No. 3.

January 14. One motile amœba found in searching four preparations.

January 15. Negative for amœbæ.

January 16. Negative for amœbæ.

January 17. Negative for amœbæ.

January 27. Negative for amœbæ.

January 28. Negative for amœbæ.

February 2. Negative for amœbæ.

February 5. Negative for amœbæ.

February 13. Patient returned for examination (discharged one week ago). He has had four or five movements daily, semisolid stools with mucus, but no blood, pain, or tenesmus. Stool examination: Semisolid, masses of mucus, no blood or pus, no amœbæ. (Four preparations examined.)

February 20. One or two normal formed movements daily, no mucus, no pain. Stool examination: Negative for amœbæ, blood, pus, or mucus.

March 20. Stools formed, normal, one daily. Two stools examined, both negative.

April 24. Stools formed, normal; two preparations negative for amœbæ, blood, pus, mucus.

May 29. Patient in excellent condition, bowels regular, stools normal. No stool obtained for examination.

CASE IV.—No. 21362, colored, Colombian; on the Isthmus three days; admitted December 13, 1909.

History. Dysentery began two months ago; diarrhœa, blood, abdominal pain. During first week in hospital patient had three to five movements a day, some tenesmus, mucus, and blood. Large active amœbæ were found.

Treatment. Ipecac, 40 grains December 15, in one dose; 35 grains December 16; 30 grains December 17; 25 grains December 18.

Subsequent History. No nausea or discomfort after ipecac. One stool a day after December 20. Discharged December 29; has been under observation five and one-half months. No further intestinal trouble.

Stool Examinations. January 3, 1910, large amœba-like bodies, no motility.

February 1. Negative for amœbæ.

March 18. Negative for amœbæ.

April 20. Negative for amœbæ.

May 30. Negative for amœbæ.

CASE V.—No. 21487, white, American; admitted from U. S. S. Prairie, December 23, 1910.

History. Dysentery three years ago in Guam, L. I. Was in hospital fifty-four days; severe attacks of diarrhœa at intervals since then; last attack seven months ago. Present attack began three days ago, severe diarrhœa, fifteen or sixteen movements a

day, griping and tenesmus, no blood. On admission patient had diarrhœa, two to nine movements a day. Microscopic examination showed blood and pus; no amœbæ were found in first three examinations; the fourth examination revealed large active amœbæ.

Treatment. Copious enemas of normal salt solution twice daily for two weeks, then discontinued, and rest and dietetic treatment given for about two weeks. Treatment with ipecac was begun January 24, 9 P.M., 80 grains; January 25, 75 grains; January 26, 70 grains; January 27, 65 grains; January 28, 60 grains.

Subsequent History. Ipecac treatment was followed by diarrhœa, with six to thirteen movements daily for one week, then two to five movements for another week. No blood, some mucus. After the second week there were from one to three or four movements daily; stools were semiformed and at times contained mucus. Patient was under observation until March 19, 1910, about eight weeks after ipecac treatment was begun.

Stool Examinations. All negative for amœbæ, January 25, February 2, 5, 8, 18, 20, 21, March 4, 8, 1910.

CASE VI.—No. 21644, colored, Jamaican; on the Isthmus five years; admitted December 31, 1909.

History. Sick three months with disentery. On admission patient was having from four to eight movements per day, with tenesmus, blood, and mucus. Microscopic examination showed large, active amœbæ, having the staining characteristics described by Craig[9] for Entamœba histolytica.

Treatment. Treatment with ipecac in capsules was begun December 31, 1910. The three initial doses were 40 grains given at 8 P.M. on succeeding days, then 30 grains daily for two days, 20 grains daily for two days, 10 grains daily for eleven days. The ipecac was preceded by an opiate.

Subsequent History. No vomiting after ipecac; a mild diarrhœa persisted during the ipecac treatment. After treatment was begun the patient was under observation a little over six weeks.

Stool Examinations. All negative for amœbæ, January 11, 13, 24, 25, February 13, 16, 1910.

CASE VII.—No. 21857, colored, Jamaican; admitted January 17, 1910; on the Isthmus four years.

History. Exploratory laparotomy on previous admission and a peculiar condition of the liver found, thought to be gummatous. Patient admitted this time with œdema of the feet and legs and ascites. He had had pain in his bowels for three weeks with diarrhœa, passing blood and mucus. Two examinations of stools, January 18 and 22, were negative for amœbæ, but positive for blood and pus. The patient was having from three to five movements a day. On February 18, innumerable large, active amœbæ

[9] Loc. cit.

were found; these were vacuolated with well-defined ectoplasm and stained like Entamœba histolytica with Wright's stain.

Treatment. Ipecac, 40 grains February 19, 20, and 22; 35, 30, and 25 grains February 23, 24, and 25.

Subsequent History. No nausea or vomiting and no increase of diarrhœa during treatment. Diarrhœa reduced from four to six movements daily before, to one to three after treatment. Patient was under observation for nearly two months after ipecac was given.

Stool Examinations. Negative for amœbæ, February 18, March 17 and 25, April 10, 1910.

CASE VIII. No. 22,005, white, Italian; on the Isthmus twenty-seven months; admitted January 26, 1910.

History. Diarrhœa for two weeks with as many as twenty movements a day, great weakness, distress after eating for one year. Hemorrhoids. Examination of stools showed mucus, blood, and innumerable amœbæ, large, active, vacuolated, with well-defined ectoplasm. They stained unlike either Entamœba histolytica or Entamœba coli[10] or the amœbæ of Cochin China dysentery. The amœbæ, on account of their size and their stain affinities, gave one an impression of solidity: they seemed massive. The endoplasm took almost a red stain because of the enormous quantity of chromatin, and the ectoplasm was almost a blue black; the nucleus was well-defined and rich in chromatin (Wright stain).

Treatment. Ipecac, 80 grains on January 27; 40 grains, January 28 and 30, February 6, 11, and 14.

Subsequent History. Vomited several times three to six hours after taking ipecac; had no diarrhœa. Was transferred to the surgical side and operated on for hemorrhoids February 21. Readmitted March 20, 1910, for another operation on an old ventral hernia. Under observation over two months and had no further dysenteric trouble.

Stool Examinations. January 28, amœbæ present. Examinations negative for amœbæ, January 30, February 9, 16, 17, 18, 20 and 21, March 21.

B. INTESTINAL AMŒBIASIS WITH DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED LESS THAN SIX WEEKS.

CASE IX.—No. 21345, white, Scotchman; has lived in Nicaragua; on the Isthmus one day; admitted December 12, 1909.

History. Dysentery two and one-half years ago, with several recurrences of active dysentery since, and diarrhœal attacks nearly every month. He was treated in Ancon Hospital during one dysenteric attack, was in bed thirteen days, and received large doses of bismuth. He has been in England for eighteen months, and while in Liverpool had dysentery and was treated in a hospital there. The present attack began one week ago on shipboard *en route* from

[10] Craig, loc. cit.

England to Colon. He has been having intense abdominal pain, tenesmus, and diarrhœa, and stools have contained mucus and blood. On admission, the patient was having four to nine movements daily, pain was intense and required morphine, the stools were thin, contained blood, and numerous small mucous masses, which were composed almost entirely of amœbæ closely packed together in the field of the microscope. These amœbæ were large, active, vacuolated, had a well-defined ectoplasm, and contained numerous red blood corpuscles; fourteen corpuscles were included in one amœba. They stained with Wright's stain like amœbæ of Cochin China dysentery. Numerous amœbæ were found December 12, 14, 15, and 17.

Treatment. Ipecac was begun December 18, 8 P.M., 60 grains; December 19, 80 grains; December 20, 60 grains; dose decreased 10 grains each night until a dose of 10 grains was reached.

Subsequent History. Patient vomited a few times six or eight hours after taking the ipecac. The stools decreased in number during the treatment; before discharge, January 8, 1910, only one formed normal stool was passed daily. The patient left January 8, 1910, for Nicaragua, and has not been heard from. He was under observation nineteen days after the first negative stool examination.

Stool Examinations. Two amœbæ found December 20 in five preparations. Stools negative for amœbæ, December 22, 23, 24, 30, 1909, and January 2, 3, 5, 8, 1910.

CASE X.—No. 21356, colored, Bolivian; on the Isthmus two years; admitted December 13, 1909.

History. Sick three months with dysentery. On admission, four to ten movements daily; stools contained mucus and blood and innumerable large, active amœbæ, vacuolated with well-defined ectoplasm and staining with Wright's stain like Entamœba histolytica.

Treatment. Ipecac was begun December 15, 8 A.M., 40 grains; dose decreased 5 grains a day for three days; only four doses given.

Subsequent History. No vomiting; diarrhœa persisted, but stools decreased in number while ipecac was being given; stools then became normal for two weeks; then there was a mild diarrhœa for ten days after patient was given "full diet." He was discharged January 17, 1910, in good condition, with normal stools, one month after ipecac treatment was begun.

Stool Examinations. Negative for amœbæ, December 18, 22, 25, 1909, January 1 and 8, 1910.

CASE XI.—No. 23304, white, American; on the Isthmus five years; admitted April 17, 1910.

History. Onset three days ago with diarrhœa; passed blood two days ago. Never had dysentery before. On admission patient had five to twelve movements daily, with pain and tenesmus; stools contained blood and numerous active amœbæ.

Treatment. Ipecac, April 18, 9 P.M., 60 grains; April 20, 40 grains; April 21, 30 grains; April 23, 20 grains.

Subsequent History. No discomfort from treatment, two to four movements daily when discharged April 27, 1910. Patient was seen May 21, and he was in good condition, and had had no recurrence of intestinal trouble. He was under observation one month after ipecac treatment was begun, but the stool examinations covered only eight days.

Stool Examinations. April 19, a few amœbæ, blood, and pus.

April 20. No amœbæ or blood, some mucus.

April 22. Stool semisolid, negative for amœbæ, blood, and mucus.

April 24. Stool negative for amœbæ, normal.

April 27. Stool negative for amœbæ, normal.

C. CASES OF INTESTINAL AMŒBIASIS WITHOUT DYSENTERY TREATED SUCCESSFULLY WITH IPECAC AND FOLLOWED FOR SIX WEEKS TO FIVE MONTHS.

CASE XII.—White, American; on the Isthmus four years.

History. The patient had been under observation two years, had never had dysentery, but had had occasional mild attacks of diarrhœa, and bowels showed a tendency toward looseness, two to four semisolid movements daily. There had never been blood in the stools, but some mucus, and the patient was frequently troubled with flatulency. Many examinations of stools during two years had always shown the presence of numerous large, active, vacuolated amœbæ with well-defined ectoplasm. They stained with Wright's stain like Entamœba histolytica. Rest and dietetic treatment and enemas of normal salt solution, quinine and thymol had no effect upon the amœbæ. They averaged fifteen to twenty per field (B and L, 1 ocular, $\frac{2}{3}$ objective) of the microscope a few days before treatment with ipecac.

Treatment. January 2, 1910, Ipecac, 60 grains, 9 P.M.; January 3, 40 grains, 8 A.M., and 20 grains, 1 P.M.—120 grains during twenty-four hours.

Subsequent History. Patient vomited two hours after the last dose of ipecac, and two or three pills were ejected. The treatment was followed by diarrhœa for two days. There was some tendency toward flatulency and mild diarrhœa for several weeks, but there has been no trouble now for three months. The patient has been under observation for five months since the treatment.

Stool Examinations. Negative, January 4, 10, 18, February 2, 13, April 25. On May 27, after a prolonged search, one amœba was found. This amœba was twelve microns in diameter, was very sluggishly motile, no ectoplasm could be seen, no vacuoles and no engulfed bacteria could be made out. It appeared to be Entamœba coli, and was not, we believe, a relic of the former infection. Only one was found.

CASE XIII.—No. 21322, white, American; on the Isthmus twenty months; admitted December 10, 1909.

History. Pain in lower abdomen for two weeks; has been having alternating attacks of diarrhœa and constipation; never passed blood. No diarrhœa or constipation in the hospital. Stool examination showed small amœbæ which could not be definitely classified, no blood.

Treatment. December 21, ipecac in 5 grain salol-coated pills, 80 grains at 8 P.M.

Subsequent History. Stool examinations December 22 and 23, negative for amœbæ. Patient was discharged December 24, but returned for examination January 3, 1910, when numerous amœbæ were found. On January 9, amœbæ were still present, and patient was advised to return to the hospital for more thorough treatment. He did so on January 10 (No. 21755).

Second Treatment. Ipecac was begun January 10, an initial dose of 80 grains being given at 9 P.M. This dose was decreased 5 grains each night for one week until a dose of 50 grains was reached, when the treatment was discontinued.

Subsequent History. Vomiting occurred once, and a mild diarrhœa persisted during the treatment, but quickly cleared up afterward. The patient was last seen May 30, 1910, about four and one-half months after the treatment. He was in excellent health and stools were normal.

Stool Examinations. Negative for amœbæ, January 11, 12, 13, 15, 16, 17, 18, February 6 and 22, April 3, May 30.

CASE XIV.—No. 21529, white, American, on the Isthmus three and one-half months; admitted December 27, 1909.

History. Diarrhœa more or less continuously for nineteen years; at times passed blood; no tenesmus for ten years; has been unable for ten years to void urine without having a bowel movement. Mild diarrhœa in the hospital, no hœmorrhoids, no abdominal tenderness, no tenesmus, no blood in stools, but numerous large, active amœbæ, about five per field (B and L, 1 ocular, $\frac{2}{3}$ objective) of the microscope.

Treatment. Ipecac was begun December 29, 80 grains at 9 P.M. The dose was reduced 5 grains each night subsequently until a dose of 10 grains was reached.

Subsequent History. No nausea or vomiting was caused by ipecac; diarrhœa was increased during the treatment to five or six movements, but subsided when ipecac was discontinued. Patient was discharged January 17, 1910; he was then having one or two movements daily. He was seen last February 27, 1910, and up until that time he had been having three or four stools daily, semiformed, normal color, no mucus or blood, no tenesmus. He was under observation nearly two months after ipecac treatment was begun.

Stool Examinations. Negative for amœbæ, January 3, 5, 6, 7, 14, 30, February 13 and 27, 1910.

D. Intestinal Amœbiasis without Dysentery Treated Unsuccessfully with Ipecac.

Case XV.—No. 21336, white, Frenchman; on the Isthmus six years; admitted December 11, 1909.

History. Amœbic dysentery and liver abscess in 1907; operated on at Ancon Hospital with good recovery. No recurrence of dysentery. Stools showed a moderate number of small sluggish amœbæ (7 to 14 microns); ectoplasm fairly well defined; small vacuoles, greenish refractility, no red blood cells engulfed. They stained with Wright's stain a rather dark blue for Entamœba histolytica; the ectoplasm stained more deeply than the endoplasm, the nucleus was ill-defined, and the chromatin scattered.

Treatment. Ipecac in 5 grain salol-coated pills begun December 22, 9 P.M., 80 grains; December 23, 70 grains; December 24, 65 grains; December 26, 60 grains; December 27, 55 grains; December 28, 50 grains.

Subsequent History. The patient vomited several times six to eight hours after taking ipecac and had a mild diarrhœa, which quickly subsided. A second course of ipecac treatment was given, but the patient did not return for examination.

Stool Examination. December 29, 1909, negative for amœbæ. January 2, 1910, negative for amœbæ. January 9, 1910, a few small amœbæ like the ones described above.

Case XVI.—No. 22721, white, American; on the Isthmus five years; admitted March 14, 1910.

History. Constipation six months, burning sensation in abdomen one month. Loss of weight; no diarrhœa. Stools contained numerous large, active amœbæ that stain like Entamœba histolytica.

Treatment. Ipecac, March 15, 60 grains; March 16, 40 grains.

Subsequent History. Ipecac treatment excited a severe dysentery, and had to be discontinued. Patient discharged March 23, 1910.

Stool Examinations. Negative for amœbæ, March 17, 20, and 23. On April 15, numerous large, active amœbæ were present.

Second Treatment. The patient took three doses of ipecac, 50 grains, on successive nights before readmission to the hospital. A dysentery was excited again, and the amœbæ persisted.

Second Admission. May 9, 1910. Patient returned to the hospital and is still under treatment. Each attempt to give large doses of ipecac excites a dysentery, and not more than twenty grains can be given. The failure of the ipecac treatment in this case seems to be due rather to the idiosyncrasy of the patient than to the ineffectualness of the treatment.[11]

Case XVII.—No. 23586, white, American; on the Isthmus five years; admitted May 3, 1910.

History. Amœbic dysentery in Ancon Hospital in 1907, active dysentery for three months. Mild attack of dysentery in 1908,

[11] Recovery subsequently followed the use of 20 grains of ipecac daily for a prolonged period.

duration ten days. Treated both times with quinine and thymol irrigations; has been feeling weak, with malaise and indigestion, two months. Tendency to constipation. No diarrhœa. Before admission, patient's stools were examined, and small sluggish amœbæ were found resembling those in Case XV. Ipecac was given, beginning with 40 grains and decreasing 5 grains daily until doses of 10 grains were reached. There was no disturbance from the treatment. The patient then returned for examination and the same kind of amœbæ were still present. He then entered the hospital.

Treatment. Ipecac, May 4, 80 grains; May 6, 60 grains; May 8, 9, and 10, 50 grains each day.

Subsequent History. Some abdominal discomfort and diarrhœa during treatment. The pills were a new lot, with a thicker salol coat, and a few, at least, passed through the alimentary canal without dissolving and were found in the feces. The patient was discharged May 15, 1910.

Stool Examinations. May 7, amœbæ, mucus, stool formed.

May 8. Amœbæ, stool semisolid.

May 9. Amœbæ, stool semisolid.

May 10, 11, 12, and 15. Negative for amœbæ.

May 22. Patient returned for examination. He has been constipated since discharged, has small, hard stools, feels very badly, weak, and easily fatigued, sweats profusely. Stools formed, no blood or mucus, numerous small amœbæ like those found on previous examinations and in Case XV. The patient promises to return for treatment.

CASE XVIII.—No. 23918, white, American; on Isthmus ten months; admitted May 20, 1910.

History. Never had dysentery; present illness began four days ago with diarrhœa. Patient had no diarrhœa in the hospital, and stools were normal in appearance. Microscopically there was no blood or pus, but very numerous large, active, vacuolated amœbæ with well-defined ectoplasm. With Wright's stain the endoplasm took a good blue, darker than the pale blue of Entamœba histolytica, the ectoplasm was deep blue, the nucleus ill-defined, and the chromatin abundant and scattered They resembled more closely the amœbæ of Cochin China dysentery.

Treatment. Ipecac in 5-grain salol-coated pills, May 22, 60 grains; May 24, 50 grains; dose decreased five grains daily for five days until a dose of 25 grains was reached. The patient was allowed "full diet" during the treatment.

Subsequent History. Patient vomited once during treatment; no diarrhœa; discharged May 30, 1910.

Stool Examinations. May 28, negative for amœbæ.

May 30. Numerous amœbæ like those described above.

THE TREATMENT OF ARTHRITIS DEFORMANS.[1]

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Among the pathological conditions which most urgently demand careful investigation and earnest consideration by the medical profession today, arthritis deformans occupies a prominent position. It does not exhibit the spectacular clinical possibilities of cancer, it will probably never arouse popular sympathy and command popular and municipal revenues as does tuberculosis, but for capacity to make its victims miserable, helpless, useless, and hopeless, it is unexcelled by any condition with which we come in contact.

Contrary to popular belief, it is not a very uncommon disease, and, also contrary to popular belief, the vastly greater proportion of the misery with which these patients have been obliged to struggle in the past, can be avoided by the utilization of present day knowledge concerning it. In order that this desirable result may be obtained, however, it is necessary that this knowledge be widely disseminated among the general practitioners, who see these cases first, whereby an early diagnosis and the early institution of appropriate treatment may be made to replace the antirheumatic and antigouty therapeusis, which has hitherto worked so much direct and indirect mischief to victims of this disease.

Diagnosis. Although the subject of diagnosis is too large to be treated at all satisfactorily in a paper on therapeusis, yet its importance justifies mentioning a few points which help greatly in differentiating this disease, after it has frankly involved the joints, from others which resemble it more or less closely. Arthritis deformans should be strongly suspected when the following conditions obtain:

1. Whenever a case of joint inflammation presents simultaneous involvement of corresponding joints on both sides of the body.
2. Whenever the maxillary articulation is involved.
3. Whenever the joints of the fingers or toes are involved.
4. Whenever muscular atrophy accompanies the outbreak. Rheumatism will sometimes produce atrophy of the controlling musculature, by compelling disuse of the joint, but this takes place in the later stages of the attack. In arthritis deformans, the atrophy frequently precedes the joint outbreak.
5. Whenever a case is accompanied, or has been preceded, by local sweats, local syncope, or local asphyxia of the parts affected, or of the corresponding parts on the other side of the body when but one side is frankly diseased.

[1] Read at a meeting of the Waterbury Medical Society, Waterbury, Connecticut, June 8, 1910.

6. Whenever trophic or pigmentary changes are apparent in the skin over, or in the neighborhood of, the affected joints, in the clavicular regions, or on the outer aspects of the forearms or lower legs.

7. Whenever a patient gives a history of having had, for sometime preceding the outbreak, stiffness or soreness of joints immediately after wakening in the morning, which disappeared after using the joints a little.

8. Whenever a case of "stiff neck" proves resistant to ordinary methods of treatment.

9. Whenever a case of apparently rheumatic joint inflammation resists thorough salicyl medication vigorously for more than a week.

Rheumatism is the disease with which arthritis deformans, in its early stages, is most frequently confounded, and in this connection it is important to remember that active arthritis deformans is frequently ushered in by an acute attack of joint inflammation accompanied by general febrile reaction, which subsides without leaving any apparent traces in the joints, and that an early diagnosis of rheumatism when the disease is really arthritis deformans, and management based upon this diagnosis, are responsible for most of the pitiable spectacles so frequently presented to us by victims of this direful ailment in its later stages.

ETIOLOGY. Four different theories are advocated, today, regarding the causation of arthritis deformans: (1) That it is a pure and simple trophoneurosis; (2) that it is a pathogenic infection; (3) that it is an autotoxemia; and (4) that it is one of the ultimate expressions of depressed cerebrospinal function, which may be precipitated by any sufficiently profound systemic toxemia, infectious, intestinal, or metabolic.

Another hypothesis has been suggested—that the disease is the result of abnormal function of one or more of the ductless glands. While there is much in the clinical history to give color to this view of the matter, it has not as yet been sufficiently worked out to give it a stand demanding serious consideration at the present time.

TREATMENT. It does not come within the scope of this paper to discuss the merits of these various theories, but I have enumerated them for the purpose of calling attention to the fact that the therapeutic indications, as far as combating the disease process, per se, is concerned, are essentially identical for all four: (1) To close possible avenues of infection, such as local suppurative, ulcerative, and catarrhal processes, carious teeth, etc.; (2) to improve the general and local nutritional processes, whereby the physiological resistance of the various tissues and the efficiency of the vital activities in general will be augmented; (3) to accelerate the elimination of katabolic products and toxins which depress the vital activities; and (4) to limit the formation of autotoxins. The treat-

ment of the disease, then, resolves itself into applying those measures which will satisfy the above-mentioned indications in the most effective manner, the relief of pain, and the management of the affected joints.

It should be emphasized, at this point, that good results cannot be attained in the treatment of this disease, unless each case is studied exhaustively and conscientiously by itself. Different patients exhibit wide variations in symptomatology, and strict therapeutic individualization is frequently necessary.

PHYSIOLOGICAL THERAPY. In the active management of the disease, per se, five remedial measures stand preëminent: applications to the general surfaces of the body of dry hot air at from 350° to 400° F., electricity, hydrotherapy, mechanical vibratory stimulation to the spine, and dietary regulation.

Dry Hot Air. The general dry hot air application is the most effective single element in the treatment of the disease, and some early cases will recover under it alone. Its physiological action may be summarized as follows: (1) It produces an immediate and powerful stimulation of the vital physical signs, and (2) a reflex stimulation of the functions of all the organs and tissues of the body, resulting in, first, an amount of reconstructive metabolism, which I believe to be in excess of that derivable from the use of other agents, and second, a degree of elimination of katabolic products and toxins which I believe to be also in excess of that derivable from the use of other agents. Its sphere of action, then, would be preëminently in conditions wherein it is desired to secure an increase in the efficiency of the circulatory, nutritional, and eliminative functions, and arthritis deformans manifestly occupies a prominent place among such conditions.

Before leaving the subject of the body dry hot air application, I wish to specify just what I mean hereby. Many who have used dry hot air for the purpose of relieving the victims of this disease will not bear me out in the statement which I have just made regarding its efficiency, and I believe that the unsatisfactory results are largely due, other conditions being equal, to differences in the method of employment rather than to weakness inherent in the remedy itself.

First, it is not a cabinet bath, heated by an alcohol lamp to 150° or 160° F., and in which the patient is treated sitting on a stool; second, it is not a Turkish bath, with a temperature of 180° or 200° F.; third, it is not an incandescent or arc light bath.

The first and second mentioned procedures are almost always debilitating and pernicious when applied with a moderate degree of frequency to cases of this disease, and in the third the light effects are so prominent as to render it impossible to produce anything approaching a proper degree of purely thermal influence. The body dry hot air application to which I refer is given by means of

a metallic asbestos-lined cylinder, long enough to include the body up to the armpits, and heated by gas, gasoline, or electricity. The treatment intensity should be from 350° to 400° F., and the immediate clinical effects are profound enough to render it necessary for the patient to assume the recumbent position, not only during the immediate application, but for some time afterward.

The heat should be run up rapidly, so as to secure the necessary degree of physiological influence as quickly as possible. As a rule, an increase in the pulse rate to 120 beats per minute or an increase in the mouth temperature of 2° F. over what it was before the treatment indicates that a proper degree of influence has been secured, and from twenty to thirty-five minutes exposure will suffice under ordinary conditions. By this method we secure a profound stimulation of physiological function, whereas, if the patient is treated for long periods with the lower degrees of heat the ultimate result is relaxing, depressing, and pernicious.

Electricity. The next most useful of the physiological agents is electricity, and the several forms of current have distinct and definite spheres of action. The one of greatest utility, because its effects, however applied, are general as well as local, is that derived from the static machine, and the spark and wave current are the most frequently serviceable modalities.

Sparks may be applied over the spine and general muscular areas of the body, for their tonic effect, at any stage of the disease, but, as a rule, they had better not be applied to joints wherein acute symptoms are manifest. When the acute process has subsided, however, and the local phenomena have become confined to soreness and fibrous enlargement, I know of no one measure which will so frequently prove effective in removing both as judiciously applied static sparks. The neuralgias which accompany the disease are also, as a rule, amenable to the static spark.

During the acute stage, the static wave current may be applied to the affected joints, twice daily, by means of sheet tin electrodes moulded to the parts, and it is frequently effective in relieving the pain as well as in producing a marked tonic effect upon the organism at large.

The general application of the high frequency current, two or three times a week in the late afternoon or early evening, by means of the spiral wire cage of d'Arsonval or the auto-condensation couch, is very helpful through its tonic and sedative influences upon metabolism and the nervous system, respectively, and sometimes induces refreshing sleep in patients who are otherwise obstinately wakeful.

The high frequency current applied to diseased joints by means of the glass vacuum electrode is fairly effective in relieving the pain, and has also seemed to me to exercise an appreciable amount of influence in removing local pathological conditions.

The continuous current, in the form of central galvanization, is helpful in improving the patient's general condition, and as a sedative to the nervous system, but I have never been able to secure any local effects with it in this disease that I could not have secured just as well, and usually better, with something else, except in muscular spasm due to nerve irritation; in the torticollis of arthritis deformans, the continuous current in doses of from 5 to 20 milliampères, for fifteen minutes, will sometimes give more satisfaction than anything else.

Hydrotherapy. The effect of the hot and cold douche to the spine, and to joints in which the process is not active, is frequently very gratifying in this disease. The circulatory and nutritional functions are noticeably augmented, and considerable influence upon the local pathological condition is often observable. The water should be applied by means of a hose, and the duration of both hot and cold applications, and the pressure at which it is delivered, must be regulated according to the reactive susceptibility of the individual patient. A marked reaction must be obtained if material curative results are to follow, but it must not be overdone.

Dietary Regulation. Absorption of putrefactive toxins from the intestine is held by some observers to be the dominant etiological factor in this disease, and no one disputes the fact that such absorption is depressing in this or any other condition. The prevention of intestinal putrefaction is, then, desirable, and this can best be accomplished by temporarily excluding from the diet those food-stuffs in which putrefactive bacteria are most active. These are meat, poultry, and fish. When these are excluded, however, care must be taken to see that sufficient protein material is supplied by other foods, and milk, eggs, nuts, and gelatin usually take the place of flesh very satisfactorily as far as the nutritional needs of the body are concerned.

Flesh should always be excluded, at least temporarily, when indican is present in the urine, and it will sometimes prove beneficial to exclude it even if intestinal putrefaction is not demonstrable. Aside from this, however, the diet should be as generous and as nutritious as is compatible with thorough digestion and assimilation.

Sour milk, or buttermilk, gives promise of being helpful in this connection. Lactic and succinic acids tend to inhibit the growth of putrefactive bacteria; hence, the frequently repeated introduction of these substances into the bowel would seem to be a logical procedure. Decided results are easily demonstrable. A pint of sour milk, administered in divided doses during the day, will usually greatly lessen putrefaction in the bowel, even if flesh is not excluded from the diet, and when it is excluded, this quantity of sour milk will practically eliminate putrefaction.

The most effective method of administering this dietary is to limit the patient's food to sour milk and well-browned, buttered toast, for a week, or longer if he will submit to it; but the average patient must be suffering a good deal before he can be persuaded to do this. From one to two quarts of the sour milk per day are required when the diet is thus restricted.

Change of Climate. A temporary or permanent change of climate is frequently productive of a certain amount of benefit in this as in other debilitating diseases, but so much more benefit is usually obtainable by the means I am discussing, without change of climate, and so few of the victims of this disease are so circumstanced as to make a change of climate possible, that this frequently-recommended element in its management may be dismissed without further mention.

DRUGS. *Alteratives and Tonics.* Medication is unsatisfactory as regards the securing of curative results. No substance has yet been discovered which exhibits a specific curative action as far as the disease, per se, is concerned, but there are a few medicines which appear, in some cases at least, to exhibit considerable influence over the condition. All of them, with the exception of thyroid extract and the salicylates, belong in the tonic and alterative classes, hence, produce their beneficial effect by means of their power to influence general or local metabolism. Prominent among them may be mentioned the iodides, cod-liver oil, the hypophosphites, arsenic in its various combinations, strychnine, and the chloride of gold and sodium.

The iodide of iron has given me the best results. It should be given for periods of six weeks, with an intermission of two or three weeks. Cod-liver oil does good service in cases characterized by emaciation, if well-borne by the stomach, Arsenic and strychnine are fairly useful, in many instances, as general tonics. Chloride of gold and sodium, and sodium or potassium iodide or hydriodic acid sometimes seem to render considerable service, but they fail to influence the disease in such a large proportion of cases that their importance is not nearly so great as is generally supposed.

Thyroid Extract. The beneficial influence which thyroid extract exhibits in some cases of this disease is particularly interesting, because of the possibility that aberrant function of ductless glands may be concerned, to some extent at least, in its etiology. R. Llewellyn Jones, of Bath, England, whose monumental work on arthritis deformans is a veritable mine of information and interest, favors its use in certain cases, especially when the thyroid gland is atrophied, or when the vasomotor phenomena peculiar to the disease are prominent. He also refers to MacAlister, Lancereaux, Revilliod, Midelton, and others as having observed good results from its administration. I have administered it to a few patients and feel that they have derived considerable benefit therefrom.

The remarkable results which have followed its administration in some cases demand that it be thoroughly investigated.

Salicyl Compounds. The relation of the salicylates to this disease deserves special mention, as they sometimes render excellent service in relieving pain and swelling. Although it is improbable that rheumatism is an etiological factor in any considerable number of cases, yet it is not so very rarely that an attack of rheumatism becomes engrafted upon an already existing arthritis deformans, and as the salicylates fail absolutely in so many manifestly uncomplicated cases, it seems reasonable to consider that many of those in which they are useful are instances of such a complication. The fact that beneficial influence is obtainable by their use only up to a certain point, would favor this view. The difficulty of making a positive diagnosis of rheumatic invasion under such circumstances is, in many cases, of course, insuperable. Whatever the explanation, the fact remains that salicyl compounds are sometimes very helpful in relieving the painful joint conditions occurring during the course of arthritis deformans.

Laxatives. Constipation is sometimes present in a degree to demand attention, and the various mineral waters, magnesium sulphate, or the aloin, strychnine, and belladonna mixtures, or compound licorice powder will be found helpful. What particular one should be used must be determined by the tolerance of the individual patient.

A substance which I wish to mention particularly in this connection, is ground agar-agar. Three or four heaping dessertspoonfuls, moistened with water and covered with cream and sugar, or sliced fruits and cream and sugar, constitute a delicious breakfast dish which is very efficient in producing a daily evacuation.

Digestants and Anti-fermentatives. Digestive disorders can generally be controlled by regulating the diet, but the digestive ferments, carminitives, charcoal, bismuth subnitrate, strychnine, and salol will sometimes have to be called upon to assist in this work.

Alcohol. There is considerable difference of opinion regarding the advisability of allowing alcohol in arthritis deformans. Some writers advocate it, some are indifferent, and some frankly disapprove of it. My experience leads me to disapprove of it as a rule. I have not been able to convince myself that patients got along any better with, than without it, and it has sometimes seemed to make the patient nervous and to aggravate the joint trouble, even when the dosage was small.

Tobacco. Tobacco is not usually well borne by these patients, and to some it is frankly and demonstrably injurious, even in very small quantities. I have observed one case in which even two cigarettes a day would stop progress toward recovery. On discontinuing the tobacco altogether, progress would be resumed. This patient was very fond of smoking, and two or three repetitions

of this experience were needed before he became convinced that it would be necessary for him to abstain. After he recovered he was able to resume the habit in moderation, but if he overdid it for two or three days in succession, stiffness and soreness appeared in his joints; these disappeared again after forty-eight hours abstinence.

General Routine Treatment. In order to get the most out of these various remedial measures, it is necessary that they be applied with intelligent system, and a routine standard is necessary as a point of departure; this can be modified to suit the individual peculiarities of the various types of the disease, and the variations in the patient's condition from week to week. That which has given me the most satisfaction is as follows:

1. Rest in a bed for at least ten hours out of the twenty-four.
2. A diet as generous as can be digested and assimilated by the individual patient, without producing putrefaction or fermentation.
3. From $\frac{1}{30}$ to $\frac{1}{40}$ grain of strychnine sulphate, and 2 or 3 grains of ferrous iodide, three times daily, half an hour before meals; and in emaciated cases from 1 to 4 drams of cod-liver oil, after meals.
4. A dose of some one of the various mineral waters, before breakfast, every two or three days, if constipation is present.
5. A body dry hot air treatment two or three times weekly.
6. Central galvanization once or twice weekly.
7. A general application of mechanical vibratory stimulation two or three times weekly.
8. A static electric application at least once every day, consisting, in acute cases, of the Morton wave current over the affected joints or spine, and in the chronic cases of long, thick sparks to the affected joints one day and the Morton wave current localized over these joints the next. In some cases one of the high frequency currents, applied either locally or generally, may advantageously replace some of these static applications, or be added to them.
9. A hot and cold douche to the spine two or three times weekly.

This scheme can be added to or otherwise modified, so that the emphasis of the weekly schedule can be laid upon any measure which may be indicated in a given case.

Relief of Pain. One of the most troublesome symptoms in severe cases, as regards management, is the constant, harassing pain in the joints and nerve trunks. The majority of these patients have become so habituated to pain that they bear a moderate amount without much complaint, but sometimes severe exacerbations will occur, lasting for hours, days, or weeks, which demand attention. The remedial measures already discussed will, in the course of their application for the condition, per se, eliminate a good deal of it, and as the disease improves, the pain lessens pro-

portionately, but the pain of these exacerbations frequently demands direct and immediate relief.

Physiological Therapy. Among the physiological measures I have already mentioned static, high frequency, faradic, and galvanic electricity as being more or less effective in this condition; to these should be added dry hot air, the electric arc and incandescent lights locally applied, the hot water bag, and hot fomentations. In some cases, an ice-cap or piece of flannel wrung out of cold water wrapped in three or four thicknesses about the joint and covered with oiled silk, will give more relief than anything else.

Bier's Hyperemia. Artificial hyperemia by the constriction method has never given me any help in connection with any phase of this disease that I could not have secured just as well with something else, and I have practically abandoned its use in the treatment of it.

Drugs. Baume analgesique (Bengue), the old familiar chloral, camphor, and aconite mixture, and the tincture of iodine externally, have given me good results in some cases.

If physiological measures and external applications fail, drugs must be resorted to, and by reason of the inefficiency of those permissible, this subject may be dismissed very briefly. Opium, or any of its derivatives, is inadvisable because of the chronic character of the trouble, because this drug loses its influence in a few days unless given in increasing doses, and because of its evil effects on the system at large. I have occasionally given coal-tar derivatives, but they also produce undesirable effects upon the metabolic and circulatory functions when continuously administered in effective doses. I have, however, used salicyl compounds and pyramidon with considerable satisfaction, in many cases. The tinctures of hyoscyamus and gelsemium are sometimes helpful in relieving the pains, in the nerve trunks particularly.

Another fairly frequent cause of pain when the larger joints are involved, is spasm of the controlling musculature, occurring during sleep. As soon as the patient relaxes into sound slumber he is awakened by excruciating pains and finds the affected muscles strongly contracted. This sometimes recurs persistently enough to interfere with the securing of a sufficient amount of sleep. Strontium bromide in 20- or 30-grain doses, repeated hourly until the condition is relieved or until three doses have been taken, will usually give good results, and patients stand its continued administration, according to my experience, considerably better than they do that of the sodium and potassium salts.

A mechanical procedure which frequently proves helpful, consists of bandaging the affected muscles snugly (not tightly enough to interfere with the circulation) when the patient prepares for the night. This will sometime prevent the spasm from occurring at all.

MANAGEMENT OF THE JOINTS. *The Acute Stage.* During the acute stages the joints should be kept at rest. I do not mean such complete rest as would necessitate enclosing the member in a splint, but the patients should be directed not to use the joints to such a degree as to produce much pain. They are sometimes urged to force the joints to functionate, no matter how exquisite the anguish induced, in order to "keep the joints from stiffening." Such advise is pernicious in the extreme. If the conditions in the joint are such that ankylosis is threatening, the irritation produced by the laceration and contusions which follow forced function, will hasten its onset and intensify its degree.

The ankylosis of this disease is divisible into two primary groups: one in which muscular spasm is the predominent factor, and another in which structural joint changes are responsbile for the loss of function. These two conditions are present in varying proportions in different cases, and it is sometimes impossible to say at first which one is most active in a given case.

The first named variety is frequently present in acute outbreaks, and disappears as the general disease process improves; if the joint structures have not been extensively altered, restoration of function will ultimately be complete. The only local treatment needed is to keep the joints at rest to eliminate degrees of motion sufficient to cause much pain, and the application to the joint of static sparks and the high frequency current by means of the glass vacuum electrode, the electric arc light, dry hot air, and the hot and cold douche of an intensity and under a pressure suitable to the individual patient.

The Chronic Stage. The second variety consists of a later development of the conditions involved in the first-mentioned, and produces some of the gravest problems presented by the disease. The pathology of arthritis deformans is not well understood as yet, but a study of such autopsical observations as are available, demonstrates that the factors to be reckoned with here are: (1) Fibrous adhesions between the contiguous joint surfaces which have resulted from degeneration of the synovia and cartilage, and overgrowth of periarticular structures, and (2) true bony union where the denuded surfaces of cancellous bone have been brought into contact by absorption of cartilage and the synovia. In the hypertrophic form the interlacking of osteophytes sometimes produces ankylosis.

Treatment of the two last named forms may be dismissed in one sentence: nothing but a cutting operation offers any hope of relief. Fortunately, true bony union and exostotic ankylosis are not very common.

Careful consideration is necessary, however, in the case of fibrous adhesions and periarticular overgrowth. The first procedure which comes into one's mind is the forcible breaking down of the

adhesions. Such manipulation is followed by good results in the ankylosis due to confinement of a joint in a splint, and in that resulting from infectious processes, in many cases. It would seem to be logically indicated in arthritis deformans, but, unfortunately, clinical experience proves that pernicious results usually follow its adoption in this disease. Motion may, indeed, be restored to the joint temporarily, but as time goes on the ankylosis returns, and the last condition of the joint is worse than the first; complete ankylosis eventually takes the place of that which was at first only partial.

Just why this measure does not produce the same permanent and happy results in arthritis deformans as in other apparently more or less analogous pathological conditions, has not yet been satisfactorily cleared up, but a possible explanation is suggested by the contention of Painter, Hoffa, and others, that the histological phenomena presented by the joint changes in arthritis deformans are those of degeneration rather than inflammation, which is to say, that the reparative and absorptive powers of the joint structures are greatly impaired in this disease. This being the case, the debris resulting from forcible breaking down of adhesions could not be properly disposed of, and the traumatism not being susceptible of normal repair might, through the irritation induced, result in the formation of more fibrous tissue and, ultimately, denser adhesions. Indeed, one can easily conceive that areas of bone might be denuded of their cartilage and true bony union be facilitated thereby.

Whatever the explanation, the fact remains that sudden, forcible breaking down of the ankylosis of arthritis deformans, when it exists to any great extent, is very rarely followed by anything but evil and pernicious results, should never, under any circumstances, be attempted while the disease manifests any active tendencies, and only in a cured case after the most careful consideration of the conditions surrounding the individual patient.

After the acute process has subsided, however, judicously regulated, gradually increased movements of the stiffened joints, both active and passive, are productive of much benefit, and frequently, partial ankylosis can be entirely removed thereby. Neither active nor passive movements should be carried to the point of exciting much pain, and if soreness or stiffness are aggravated, it may be looked upon as an indication that the movements are excessive.

The physiological measures useful in treating the first-mentioned variety of ankylosis are just as useful in connection with the graver form.

Results. *Early Cases.* Under the treatment herein outlined, early cases usually recover promptly. By early cases, I mean those in which structural joint changes have not yet progressed sufficiently to produce ankylosis. If the patient will then take

good care of himself, avoid excessive nerve strain, and so regulate his diet as to eliminate intestinal toxemia for a couple of years, he will ordinarily retain his regained health. An exception to the foregoing statement is to be noted in connection with recurrent cases caused by attacks of la grippe or other infectious processes. These are beyond the patient's control, but recurrences so caused usually respond to treatment as kindly, in some cases even more kindly, than did the original attack.

It is the facility with which these early cases respond to proper treatment that causes early recognition of the disease, whereby the early institution of appropriate management becomes possible, to assume such importance.

Late Cases. In the late cases the prognosis is not good. Persistence in thorough treatment extending over long periods of time, from one to two years, will check the disease process, per se, and stay further destruction of joints in many cases. In a few (a very few) cases complete ankylosis will yield and the restoration to health will be complete. In the great majority of these late cases, however, all that can be attained is relief of pain and a certain amount of improvement in the general condition, whereby the victim's life is rendered more endurable. In a considerable proportion of late cases, treatment is of absolutely no avail and the disease continues its progress unabated.

Statistics. In 1904, I reported a series of 51 cases to the Section on Practice of Medicine of the American Medical Association. The results obtained in this group up to that time may be roughly indicated as follows: 17 per cent. had been free from all manifestations of the disease and pursuing their ordinary avocations in apparently unimpaired general health, for from one to two and a half years; 74 per cent. had been benefited in varying degrees; 9 per cent. had been absolutely uninfluenced by treatment.

Up to the present time I have had under observation 160 cases and the percentages have changed so that they now read as follows: 25 per cent. have been apparently cured; 65 per cent. have been benefited in varying degrees, and 10 per cent. have been entirely uninfluenced by treatment. The increase in the apparently cured cases is attributable to the fact that a greater number of early cases have been treated since the first series was reported.

It is true that 25 per cent. of cures cannot be looked upon as a particularly brilliant showing, but when we consider that out of these 160 cases 40 discontinued treatment prematurely for various reasons, some while they were deriving benefit in varying degrees, and that the vast majority of them were late cases, the conclusion appears to be justified that the prognosis under the later therapeutic methods is not nearly as gloomy as it has been

in the past. The smallness of the percentage of cures, on the other hand, emphasizes forcibly the thought which I wish to impart, that is, that early diagnosis is of the first importance, because the vast majority of early cases respond happily and promptly to appropriate management.

THE LEG AND ARM PHENOMENA IN TETANY.

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In recent years an increasing interest has been taken in tetany because of the attractive field for research which its etiology and treatment have offered. Although these considerations have overshadowed the study of the clinical features of the disease, that phase of the subject has not been entirely neglected, as is evidenced by the fact that new tests have been developed, notably the leg and arm phenomena. These have been of late the subjects of some discussion in German neurological circles, on account of the desirability of having for diagnostic purposes, in the quiescent or free periods of the disease, reliable and simple tests to supplement the tests of Erb and Trousseau and the less characteristic signs of Chvostek and Hoffmann.

In 1906 I had an opportunity to study a case of postoperative tetany for a long period at the French Hospital, New York. Of particular interest in the case was the constant response of the muscles of the extremities to the arm and leg tests. A complete report of the case was published,[1] yet a brief review of the features bearing on these new phenomena may prove of interest. The patient, a woman, aged thirty-three years, from whom the left lobe of the thyroid had been removed elsewhere several years before, developed the typical symptoms of tetany four days after I performed a partial thyroidectomy, the isthmus and adjoining part of the right lobe being removed, with ligation of the inferior thyroid vessels of the right side. Most of the right lobe was left. Among the significant features of the disease were frequent attacks of symmetrical and bilateral tonic contractures of the hands and feet and the presence of Chvostek's and Trousseau's signs, the latter characterized by slow contractions accompanied and preceded by cramp-like pains. "Contractures also resulted from making the sciatic nerve tense by holding the patient in a sitting position, so that the trunk and thighs were flexed beyond a right angle, with the legs extended; or by putting the nerves of the brachial plexus on the stretch by elevating the arm above the

[1] Annals of Surgery, October, 1907.

head with the forearm extended (extreme abduction). The contracted muscles were always board-like to the touch" (p. 510).[2]

The methods of evoking these contractures in the extremities were shown by illustrations, some of which are well reproduced in Osler's *Modern Medicine*.[3] In the leg test the muscles of the calves became markedly contracted; the feet took a position of extreme plantar flexion, with the toes usually turned forcibly toward the sole. In the arm test the abduction must be as extreme as possible, the elbow being held in full extension; the brachial plexus is thus put upon the stretch. The hand took, as a rule, a position similar to that produced by stimulation of the ulnar nerve, with at times flexion of the wrist. The average time from the beginning of the tests to the onset of the contractures was about one and one-half minutes, though this was very inconstant, being sometimes more, sometimes less. It was noted that after about twelve months, while the patient was under treatment, these two tests, coincidently with Chvostek's and Trousseau's, became less marked and finally elicited no response. In a general way, then, it is evident that susceptibility to all of these tests may be simultaneously present; no evidence, however, appears to have been brought out as to the relative reliability and sensitiveness of Trousseau's sign, the most reliable of the older methods, on the one hand, and the arm and leg tests on the other. It was pointed out in the report of the case that "the value of the two tests dependent upon stretching the nerves of the brachial plexus and the sciatic nerve, which were so striking in our case, cannot be estimated until repeated trials have been made in further cases" (p. 527). Consequently, it is gratifying to note that Schlesinger[4] Alexander, and others have recently independently observed and confirmed the leg phenomenon, which apparently was demonstrated for the first time in my case, in numerous cases of tetany of various kinds. With the exception of Alexander, who has of late independently noted and reported the arm test as present in one case, there seems to have been no further effort to test the arm phenomenon.[5]

If these tests are sufficiently constant in the free interval to be reliable for diagnosis, the ease with which they can be made should

[2] The passages quoted refer to the original case report.

[3] Osler's Modern Medicine, vol. vii, pp. 800 and 802, Plates xxxiv and xxxv.

[4] Ueber ein bischer unbekanntes Symptom bei Tetanie (Beinphänomen), Wiener klinische Woch., 1910, No. 9; Weitere Erfahrungen mit dem Beinphänomen bei Tetanie, Neurologisches Zentralblatt, 1910, No. 12; Alexander, Ueber das Beinphänomen bei Tetanie, Deutsch. med. Woch., 1910, No. 22; Pool, Tetany Parathyreopriva, Annals of Surgery, New York, October, 1907.

[5] Ferenczi's experience and conclusions should be mentioned in this connection. As reported in the Neurologisches Centralblatt, 1904, vol. xxiii, p. 924, he presented at the Section for Psychiatry and Neurology of the Budapest Medical Society, February 29, 1904, a boy, aged fourteen years, suffering from typical tetany. He noted that contractures occurred on lifting the arm, and interpreted it as Trousseau's sign. He concluded that Trousseau's phenomenon was of vasomotor origin, because in the elevated arm he found the radial pulse only slightly or not at all palpable.

render them of value as an "additional demonstration of the mechanical excitability of the motor nerves by the stretching of the sciatic and the nerves of the brachial plexus" (p. 535). It is in the hope that this communication may cause sufficient interest in the matter to stimulate investigation as to the relative constancy and sensitiveness of these two tests in various forms of tetany that I submit this report.

THE SIGNIFICANCE OF CARDIORESPIRATORY AND SUBCLAVIAN ARTERY MURMURS.

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Murmurs variously designated as cardiorespiratory, cardiopulmonary, cardiopneumatic, or systolic vesicular have been long recognized. Their causation is obscure and their significance is not fully established. Many of the older clinicians believed them to be commonly associated with pulmonary tuberculosis, but in recent years they have come to be regarded as accidental and as of no particular significance. A review of the standard text-books shows that in some instances there is no mention made of them whatsoever, while in others there is a difference of opinion as to what interpretation should be put on their presence. While some view these murmurs as accidental and of no particular moment, there is considerable support given to the theory that they are most commonly associated with disease of the pleura or lung, especially tuberculosis of the lung.

The commonly accepted theory as to their causation is that during the inspiratory phase the lung is brought into closer relationship with the heart, and as the latter contracts the air in the adjoining pulmonary vesicles is forced out into the bronchi or into an adjacent cavity. While they may be heard with the heart beating but eighty or ninety times to the minute, they are, as a rule, associated with a rapid cardiac action. Sahli states that they depend on variations of the intrathoracic pressure connected with systolic diminution in the size of the heart, which is, we believe, the true explanation, although the exact mechanism is not clear. We incline to this view because transient murmurs having all the characteristics of a cardiorespiratory murmur may be heard in individuals laboring under nervous excitement, with a rapidly acting heart, and

in many healthy young adults after violent exercise. In these individuals the murmur disappears as the heart regains its normal rate.

The cardiorespiratory murmur belongs to that variety of breath-sounds known as "cog-wheel." The murmur is dependent on the movement of the heart, and is heard principally in its neighborhood. It is a short, whiffing, interrupted breath sound, the interruptions being regular and having a rhythm of obvious cardiac origin. Furthermore, it is invariably associated with the systolic phase of the cardiac cycle. It varies in intensity and also in the number of times it is repeated during a particular respiratory act, depending on the rate of the heart and upon the length of the respiratory phase.

The distribution of these murmurs is fairly definite, being, as a rule, in the immediate neighborhood of the heart. They are best heard along the left border of the heart, especially in the second and third interspaces, and in the fifth and sixth interspaces, near the apex, and at the angle of the left scapula. They are less frequently heard along the right border of the heart. They are almost invariably heard during inspiration, but may be heard during expiration or during inspiration and expiration. They may be heard when the individual is breathing quietly, or only on deep inspiration. Posture also seems to influence them, as they may disappear in the recumbent posture, or may be heard only in that position. Furthermore, they do not always remain constant, but may disappear and reappear from time to time at subsequent examinations. They are to be distinguished from endocardial murmurs from the fact that they disappear when the breath is held.

As has been already stated, cardiorespiratory murmurs have been noted as being frequently associated with pulmonary tuberculosis. Lewis[1] has recently recorded 48 cases in which he encountered this murmur. He divided these cases into three groups. In group one, there were 24 cases of undoubted tuberculosis, with strong evidence in favor of pleural involvement. In group two there were 12 cases, in which there was strong evidence of a tuberculous lesion, but in which there were no signs of pleural involvement. In group three, there were 11 cases, with doubtful signs at one or both apices, but in which the history was strongly suggestive of a tuberculous lesion. The only case in which there was no reason to suspect a tuberculous lesion was in a case of double aortic disease.

Lewis also quotes Henssen as having encountered a cardiorespiratory murmur in 39 out of 268 cases; 27 of the 39 had tubercle bacilli in the sputum. In 88 youths in a military school he found the murmur in 4; 2 were suspected of having tuberculosis, while the others gave a history of having had a left-sided pneumonia some years before.

Our results were as follows (Landis): In 228 apparently normal

[1] Quarterly Journal of Medicine, January, 1910.

individuals (95 males, 133 females) a cardiorespiratory murmur was heard in but 2 instances. These cases were examined but once, in the erect posture and during normal respiration and during deep breathing. Of 26 general medical cases (21 males, 5 females) cardiorespiratory murmurs were heard 7 times. In 4 instances the murmur seemed dependent on a tachycardia; 2 of these cases (females) had exophthalmic goitre, while the other 2 (males) had a murmur, apparently due to nervous palpitation, which disappeared as the heart quieted down. In the other 3 the condition present was chronic gastritis, aortic regurgitation, and a convalescent pneumonia in which the left base had been involved Of 74 tuberculous cases (45 males, 29 females), a cardiorespiratory murmur was present 29 times (23 males, 6 females).

Of 143 cases (Munford), representing a variety of conditions, but for the most part cases of tuberculosis, specifically examined for a cardiorespiratory murmur, the murmur was heard in 32 instances. Of this number, 16 had undoubted tuberculosis. Observations were also made on 1552 men entering the freshman class of Cornell University in the fall of 1909. In the examination of these cases the excitement incident to the ordinary medical case is almost negligible. After auscultation of the heart and lungs, the students were required to "chin" themselves as often as possible, and then the heart and lungs were again ausculted. In many instances murmurs were then heard which had not been noticed previously. Cardiorespiratory murmurs were heard in 181 instances (11.8 per cent.). In addition to these 181 transient cardiorespiratory murmurs, there were 117 instances of accidental murmurs, apparently endocardial in origin.

The violent exertion incident to the "chinning" also produced in nearly all the cases jerking respiratory movements, usually near the heart, often over the entire left side, and at times over both lungs. Further studies in this direction are necessary, as the sounds produced in the heart and lungs after violent exertion are very confusing and difficult to classify.

Cardiorespiratory murmurs, as already mentioned, may be confined to one particular area or may be heard in two or more of the places of election. The distribution in the 70 cases observed by us was as follows: Near the apex, 29; left border, second and third interspaces, 23; at the angle of the left scapula, 19; along the left border, 19; along the right border, 16; in the axilla, 4; at the angle of the right scapula, 1.

As a rule, these murmurs offer no difficulty in their recognition, and can be readily distinguished from those produced by the heart alone, whether functional or organic, by having the patient hold his breath. In 3 instances a cardiorespiratory murmur was associated with a mitral systolic murmur. In all 3 the cardiorespiratory murmur disappeared when the patient held his breath; and in 1 case it also disappeared when the patient assumed the recumbent posture.

The only murmurs apt to cause confusion are those limited to the pulmonary area. Systolic murmurs in this situation are common in cases of advanced pulmonary tuberculosis, and it is not always easy to say whether they are produced in the pulmonary artery, in the heart itself, or whether they should be classified as cardiorespiratory. If heard in this area alone, they had, in most instances, best be omitted from the latter classification.

Eliminating the instances in which the murmurs were heard as the result of severe exercise, it is significant that they should have occurred in tuberculous cases in 45 out of a total of 70 cases.

The cases studied for cardiorespiratory murmurs, a total of 497 cases, were also examined for the presence of murmurs in the subclavian arteries.

Attention was first directed to murmurs in the subclavian arteries by Stokes, in 1837, his original observation being made in a case with tuberculosis of the left apex. It seems to be the general impression that these murmurs are in some way connected with alterations in the pleura or lung in immediate relation with the artery. This is especially true of the pleura, which may become adherent to the sheath of the artery, and in this way lead to alterations in the caliber of the vessel. As tuberculosis is the most common affection of the lungs, and as the overlying pleura in a chronic tuberculous process is almost always thickened, it naturally follows, if the accepted theory is correct, that these murmurs should be more common in tuberculous individuals.

It must be borne in mind, however, that thickening of the apical pleura is a not uncommon finding, and while often assumed to be tuberculous in origin, this assumption is in many cases not susceptible of proof. There is no doubt that these murmurs are often heard in individuals presumably healthy, and in those who while suffering from illness present no evidence of pulmonary tuberculosis. Palmer (quoted by Walshe) found subclavian murmurs in 102 of 497 healthy workingmen between the ages of sixteen and forty-five years—23 on the right side, 31 on the left side, and 28 on both sides.

Murmurs in the subclavian artery are said to be more common in men than in women, and occur more often on the left side than on the right. The punctum maximum is frequently at the junction of the middle and outer thirds of the clavicle. They are always systolic in time and may be heard either on inspiration or expiration, or both, but are far more often heard during the inspiratory phase. They may be heard constantly or may disappear for a time; in some instances a change of posture from the sitting to the recumbent position will cause their disappearance. Altering the position of the arm is also said to be a factor in their production, while deep breathing makes them louder, and in some instances this procedure is the only way they can be heard. In examining

for these murmurs it is essential that no pressure be exerted on the artery by the stethoscope.

In all there were 31 cases in which a subclavian murmur was heard: Males, 23; females, 8; tuberculous cases, 20; non-tuberculous cases, 11; murmur on the right side only, 8; murmur on the left side only, 14; murmur on both sides, 9; murmur during inspiration only, 23; murmur during expiration only, 6; murmur during both, 2; tuberculous disease of the right apex, 8; tuberculous disease of the left apex, 2; tuberculous disease of both apices, 5.

In 2 cases change of posture influenced the murmur; in 1 the murmur disappeared in the recumbent posture, while in the other the recumbent posture brought the murmur out. In 7 cases a cardiorespiratory murmur was also present.

The murmur did not always occur on the side on which there was obvious disease. In 3 instances a murmur was heard on the right side when tuberculosis of the left apex was present, and in 1 the murmur was present on the left side, with signs indicative of disease of the right apex.

The fact that the murmur is heard more frequently on the left side than on the right side even in those cases in which the disease is more extensive on the right side, suggests that there may possibly be some anatomical variation which would account for the left side being more frequently the site of the murmur.

In conclusion, it may be said that while neither the cardiorespiratory nor the subclavian murmurs are pathognomonic of tuberculosis, it is at least suggestive that they should be so frequently encountered in this disease.

THE PROGNOSIS IN CHRONIC VALVULAR DISEASE OF THE HEART.[1]

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I purpose to limit the following discussion to the chronic forms of heart disease, particularly to those exhibiting endocarditis of the valves and to arteriosclerotic changes in the valves and coronary arteries; and to depart from the customary clinical paper by basing it upon personal observation of private cases, and not upon combined hospital and private cases with those culled from the literature and with the added opinions of the masters in medicine. The motive for such a paper is a mixed one. In the first place our

[1] Read at a meeting of the West Branch of the Philadelphia County Medical Society, March 15, 1910.

literature is overweighted with hospital cases and with the statistics based upon them. This does very little harm when we are studying the pathology and diagnosis of disease, but when we wish information about the duration and prognosis of a particular disease hospital cases may be very misleading. As diseases of the heart have been of great interest to me ever since I began the practice of medicine, and as I have been on the staff of the Philadelphia General Hospital for a number of years, the opinion expressed is at least not the result of one-sided observation.

Another motive for treating of private cases only arises from the feeling that every member of our profession should strive to advance our knowledge of medicine; it is a duty which he owes his profession. And it would seem that after practising twenty years even the poorest of us should have learned something which is worth imparting.

AGE. Of the 63 cases studied 40 were fifty years old and over, 28 were over 60 years of age, 16 were over seventy, 7 were over eighty, and 2 were ninety years of age. Two-thirds of the cases, therefore, were fifty years old or more. The impression which is common among laymen that disease of the heart necessarily means sudden death, we have of course long known to be erroneous. But I believe that a great many physicians take much too gloomy a view of the seriousness of disease of the heart. Perhaps we can appreciate the facts better if an attempt is made to estimate the duration of the disease.

DURATION. Of the cases which form the basis of this paper 37, or more than half, are still under observation. Of the remaining number some have died and some have passed from observation, but in very few instances could death have occurred without my knowledge. It has been possible, therefore, to watch a number of the cases for periods of ten years or more, and it is no uncommon experience to see comparatively little change in that time, and often very little abridgement of activity. Some of the patients have had valvular disease for much longer than ten years. In one patient, with aortic insufficiency, the history points to a duration of at least twenty-two years. At that period in the past she was taken to a prominent clinician who made the diagnosis and enjoined her from any exertion which would tax her heart. How long she had the lesion before it was recognized is of course altogether uncertain. But even today it is rather a lesion than a disease; for while she is weak and gets easily tired, she is able to look after her household and family.

In another woman, now fifty-six years old, I have myself been able to keep watch of her progress for nearly twenty years. She had mitral stenosis and some arteriosclerosis at that time. The lesion had probably existed for years before that time. This patient has enjoyed very good health, though she was never regarded

as a vigorous woman. She has survived typhoid fever, appendicitis followed by operation, embolism of the cerebral arteries, and, since this paper was begun, pneumonia of both lungs.

In a woman, now twenty-five years old, I made a diagnosis of mitral insufficiency sixteen years ago. There has been scarcely any inconvenience from the lesion, though she has not quite the endurance she should have, and there is some dyspnœa occasionally following unusual exertion.

In another lady, eighty-eight years of age, there was marked dilatation and hypertrophy of the heart when I began attending her about twelve years ago. It would be a fair estimate to say that the lesion had existed at least as long before I saw her. She has only died since this paper was begun.

In a woman, thirty-five years old, the disease of the heart probably dates back to an exceptionally severe attack of scarlet fever when she was five years old, that is, thirty years ago. She was taken sick in May and was unable to walk until the following September. The lesion is an aortic insufficiency. I have attended her for ten years and she is in better health and has more endurance now than she had ten years ago.

In the great majority of the cases one cannot tell how long the lesion has been in existance. This is partly because our patients come to us with the lesion well established, that is, in many cases it comes on insidiously, and partly because we do not wish to make too direct inquiries about the heart lest we alarm the patient. There can be no doubt that the heart lesion may remain a lesion and not become a disease under favorable circumstances for a much greater number of years than we commonly suppose.

Sex. It has seemed to me that after the stresses of pregnancy and the child-bearing period women bear heart disease better than men. Yet in the series of cases underlying this paper, of the 28 cases over sixty years of age, only 12 were women. The only reason for better tolerance, if they do bear the disease better, is that they are able to lead a more sheltered and protected life. They do not have to go out in all weathers, breast high winds, wade through snow, catch trolley cars, and keep fixed appointments. They are enabled to a much greater extent than men to wait for favorable conditions when they go abroad. But, of course, the men who bear heart disease best are also those who can be shielded from stresses and strains.

Some one may reasonably object that in speaking of the prognosis in old persons with valvular lesions due to atheromatous changes one should really speak of the prognosis of arteriosclerosis. That is true. Nevertheless it is convenient to consider the cardiac lesion as the most obvious local expression of the disease. Moreover, in at least some of the cases, the arteriosclerosis of the valves has an infective process superimposed upon it.

Clifford Allbutt aptly says that the main factors in the prognosis of heart disease are four: The age of the patient, his calling, temperament and habit of body, the specific kind of lesion, and the degree of the lesion.

In the present group of cases it will be remembered that two-thirds of them were fifty years old or more. While it is unlikely that in most of the cases the lesions started in childhood, it is probable that in some of the cases they did. For example, the young woman of twenty-five who has had a cardiac lesion for sixteen years practically without symptoms may reasonably look forward to a considerably longer life with good health. In general, we must admit that in persons past middle life the heart does not accommodate itself to a lesion as well as it does in adolescence. On the other hand, a heart lesion which comes on gradually as part of an atheromatous process is often astonishingly well borne. I have been attending for more than ten years a man who exhibited some enlargement of the heart and mitral insufficiency when I first saw him. The lesion seemed like an old one then. The loud, rough, coarse systolic mitral murmur has scarcely varied during the years I have attended him. While he has had various ailments the heart has called for no treatemnt and has scarcely ever received any. In other words, there has been a persistent quiescent lesion, but very little disease.

While, therefore, the old heart has less power of adaptation than the young heart, the lack is in part compensated by the lessened stress which sometimes the older heart has to endure. Therefore, if a man during his early life has acquired a competency which enables him to live comfortably without hard work, worry, or much stress of any kind he may, barring accidents, live almost as long with a heart lesion as without it.

Occupation is an important factor in prognosis. One important reason why the prognosis in private cases is so much better than in hospital cases is that among the former there are fewer belonging to the laboring classes. Undoubtedly a man with heart disease is better off doing office work than digging trenches; but we all know that a man doing office work or engaged in professional activity may be so greatly worried and harassed that his heart will suffer.

Habit and temperament are also important factors. A man who eats to excess or who drinks immoderately is more prone to degeneration of the heart and kidneys as well as to accident and acute illness. Moreover, such men are more apt to be sluggish in habit, to be overweight and have flabby muscles. The person who bears chronic heart disease well is he who is of spare build and temperate habit. He does not overwork his metabolic apparatus and has no extra load to carry.

If a man has such a reasonable temperament that his physician can tell him he has heart disease without unduly alarming him, and

the patient will use his knowledge to adapt himself to the altered mode of life which the weakened heart demands much damage may be spared the heart and life be lengthened with maintenance of comfort and usefulness. If, on the other hand, he is nervous and fussy, given to undue haste in his movements, prone to run for a car or to go upstairs two steps at a time, if, in a word, he cannot be schooled into deliberateness of action, he will wear out his heart much sooner.

Another factor in prognosis is the extent of the lesion. The greater the obstruction or the leakage from a valve the greater the strain upon the heart. We have all seen cases of aortic insufficiency for example, in which the jumping arteries, a pronounced water-hammer and capillary pulse, and a marked diastolic murmur all betokened a very decided insufficiency. There can be no question that in such a case the strain upon the left ventricle is far greater than in a case in which the leakage is hard to make out, in which the pulse has scarcely any water-hammer character, and in which there is no capillary pulse. I am not forgetting that the prognosis in all cardiac affections depends more upon the integrity of the muscle than upon the valvular lesion, but only showing how an extensive valvular lesion leads to more damage and strain than a small lesion.

The extent of a mitral lesion may be inferred from the amount of dilatation of the right heart, and the secondary effects upon the lungs, liver, and other organs. A well preserved accentuated pulmonic second sound is of good prognostic import. While in general the character of the murmur is of no aid, it has seemed to me that a long murmur which wholly replaces the first sound indicates considerable regurgitation. When the first sound is well preserved there is either an associated stenosis or there is not very much regurgitation.

The Kind of Lesion. It is generally conceded that aortic insufficiency is the most serious of the valvular lesions. Mitral obstruction stands next in order of gravity, mitral insufficiency ranks third, and aortic obstruction fourth. Lesions of the tricuspid valve are usually secondary to mitral lesions, in which case the prognosis is that of the primary lesion; whereas, lesions of the pulmonary valve are usually congenital and result in death of the patient either in infancy or by puberty. But aortic insufficiency is less serious when it has followed an endocarditis than when it occurs as the result of arteriosclerosis, chiefly because in the latter form there is greater liability to disease of the coronary arteries, upon the soundness of which depends the integrity of the heart muscle; and also because many patients with aortic lesions have them as the result of syphilis, which causes degeneration of tissues other than the arteries. But the prognosis is good as long as the left ventricle is not much enlarged, and subjective symptoms are absent, and the rhythm is normal. Sudden death from blocking of the coronaries or paralysis

of the ventricles is more apt to occur in this lesion than in any other valvular lesion.

Mitral obstruction developing in early life and serious enough to cause symptoms shortens life, materially hampers its activities, and subjects the patient to dangerous complications. The majority of patients die under forty years of age. Many show poor physical development. I have noticed in girls a later appearance of menstruation and a tendency to irregularity or to amenorrhœa. After marriage some are sterile, and some abort or miscarry in pregnancy, while others die during labor or soon afterward. I am speaking now not of slight lesions but of those developing in early life and serious enough to produce symptoms. Moreover, these patients form the bulk of those showing embolic phenomena of the brain or lungs, and usually die very rapidly if pneumonia sets in.

When the lesion is a slight one it often causes practically no symptoms. The patient learns to adjust himself to a lessened range of activity, and in other respects seems perfectly well.

In advanced cases a persistent arrhythmia may develop. It is of serious import in proportion to its constancy. There is probably involvement of the bundle of His.

Of mitral insufficiency one need only say that slight grades of it are very common and that they do not much impair the activity of the patient or shorten his life. The serious grades bring all the well-known symptoms of broken compensation in their train and greatly shorten life.

Etiology. In the cases which form the basis of this study it has not been possible to ascertain the cause in most of them. A definite rheumatic history is the exception. To accept the vague leg ache, backache, and tonsillitis as satisfactory evidence of rheumatic fever is unscientific. Undoubtedly rheumatic fever is a very frequent cause of endocarditis and pericarditis, but until we know the causative agent we are likely to attribute many cases to rheumatism which the more accurate knowledge of the future will show were due to other infections. I have seen cases in which there was a distinct history of tonsillitis followed by endocarditis. And I have recently seen an endocarditis follow an ordinary cold with laryngitis. In many of the cases which are found in persons past middle life the endocarditis is only a part of the process which is making progressive changes in the arteries. These cardio-arterial cases form the bulk of the cases which show heart lesions in old persons. In many of them, most of them, I believe, there is also degeneration of the kidneys in spite of the fact that we may not be able to find proof of this in the urine.

As the cause in so many of my cases is uncertain it will be impossible to draw any inference in prognosis based upon the etiology.

In distinctly rheumatic cases the prognosis must often be guarded owing to their liability to a fresh rheumatic endocarditis. The

prognosis improves somewhat with the age of the patients. Young children are very prone to it, older persons much less so. The liability of every damaged valve to a septic endocarditis must also be kept in mind.

Importance of Subjective Symptoms in the Prognosis of Heart Disease. The tendency in modern times has been to pay more and more attention to physical methods of studying heart lesions. Physical diagnosis has been an attractive study for many of us and we believe that accuracy in diagnosis is more nearly possible now than it was formerly. But physical methods are more valuable in diagnosis than in prognosis. They are a better guide to the lesion than to an estimate of the functional power of the heart. In prognosis we do not so much need to know whether there is a heart lesion as we do whether or not the patient has heart disease. This distinction is all important for prognosis and for treatment; and in making it we should rely upon the presence or absence of subjective symptoms of heart weakness. If a man is able to perform the ordinary duties of his daily life without causing pain or any uneasy feelings referable to his heart, without causing dyspnœa, vertigo, dizziness, faintness, fluttering, irregular action, palpitation or swelling of the feet—such a man may have a heart lesion but he has not heart disease, and as long as subjective symptoms remain in abeyance the prognosis is good. Let us try to estimate the value of the subjective symptoms.

Dyspnœa. Dyspnœa is so common that it might almost be said to be a constant symptom of cardiac weakness. It occurs in all varieties of lesions, but is more frequent in mitral than in aortic valve lesions, and is evidence of some weakness of the cardiac muscle. It may occur following some acute strain such as athletes sustain, or such as happens at times to mountain climbers, or to women in the late stages of pregnancy or in labor. In these cases there is usually some acute dilatation. If the ventricle is fairly sound the dilatation under rest quickly subsides and the dyspnœa with it. Dyspnœa in valvular lesions also is the consequence of dilatation of the heart or degeneration of its fiber, the latter often preceding and accounting for the former. We find dyspnœa also nearly constant in fibroid heart and in fatty heart, while sometimes with a certain weight or oppression in the chest it is the dominant symptom in angina pectoris.

How shall we estimate the gravity of the symptom in a particular case? By its frequency or constancy, and by the effort which is necessary to its production. Some patients are always short of breath, and upon the least effort it is greatly aggravated. I have seen patients so short of breath that the effect of being fed made them pant for breath, and urination and defacation almost made them faint. Between this extreme degree of dyspnœa and that induced only by running or hastily climbing several flights of stairs,

there are all grades. A very important question to put to a cardiopath, therefore is, how much can you do without getting out of breath? The prognosis will be grave in proportion to the ease with which dyspnœa is induced, its intensity and constancy, and its cause. The prognosis is worse when the dyspnœa is the result of degeneration of the muscle or angina pectoris than when it is due to dilatation secondary to a valvular lesion or to some acute strain.

Cardiac Pain. Under this head may be grouped for convenience the various abnormal sensations which have to do with the heart. They range from the slightest disagreeable consciousness of the heart, from slight soreness or aching, or uneasiness, up to agonizing pain. If my own experience is any guide the latter is rare. More frequently even in true angina pectoris the patient will complain of a heavy weight pressing down upon the sternum and making breathing difficult; or there will be aching or soreness in the heart, with occasional shooting pains in the cardiac region or in the left arm, shoulder, neck, or right arm. Sometimes the pains are referred to the stomach and resemble gastralgia, acute indigestion, or the gastric crisis of tabes. I have had two patients die of angina pectoris with gastric symptoms. One died in his first seizure; the other had a number of attacks extending over two years before he had one which was distinguishable as connected with the heart.

How shall we tell whether the pain is due to true angina or not? True angina pectoris is more apt to occur in a man between fifty and sixty years of age who has led a life demanding more or less intense application, or which has subjected him to worry and anxiety. I believe also that the use of alcohol, tobacco, tea, and coffee are contributory causes in many cases. Furthermore, angina pectoris is more frequent in those who show arteriosclerosis, atheroma of the aorta, and aortic insufficiency. Finally, it is the characteristic mode of death in certain families. In 2 cases I have noticed a peculiar hollow or bell-like second aortic sound which may have some diagnostic value. The pulse is not of much value. Early in angina it is usually of high tension. Later it may vary greatly from day to day or even from hour to hour. I have seen it at one visit fairly regular and strong, in an hour unsteady and difficult to count. In some cases there may be marked arrhythmia with great frequency. In the diagnosis of anginal pain one should therefore consider the age and sex of the patient, the family history and tendency, the presence or absence of signs of cardiac degeneration, dyspnœa, oppression, pallor, weakness, etc., and the presence or absence of a cardiac lesion, particularly one involving the aorta.

Arrhythmia. Arrhythmia may have very little prognostic value or a great deal. I saw some years ago, an old gentleman, eighty years of age who had marked irregularity of the heart, which, however, caused him very little disturbance. He told me he had had it for twenty years. Broadbent mentions a similar case. On the

other hand, the arrhythmia which comes on in the late stages of mitral stenosis or aortic insufficiency is of very grave significance, especially if it is persistent. Probably in the mitral cases the sclerotic process has extended from the valves so as to involve the bundle of His. In the aortic cases it may be an expression of serious impairment of the cardiac muscle the result of sclerosis of the coronary arteries. In some of the milder cases the cause seems to be some irritability or debility of the cardiac muscle depending upon a gastrointestinal cause, or upon the effect of coffee or tobacco, or upon some mental stress. In cardiorenal cases one cannot exclude a toxemia of renal origin. A cardio-sphygmogram is of great value in diagnosis and in prognosis.

VERTIGO AND DIZZINESS. As symptoms of cardiac disease vertigo and dizziness may occur in any lesion, but are more common in aortic lesions. One of my patients complained only of an uncertain feeling in her head. She could not always walk straight, and felt uncertain when she started whether she was going to reach her destination or fall down. These symptoms indicate failing heart power and to that extent are of unfavorable prognostic import.

WEAKNESS. The patient may complain most of weakness, of getting tired physically and mentally following very little effort; or the weakness may show itself principally in a difficult digestion with some pallor and malnutrition. These symptoms often indicate some degenerative change in the cardiac muscle.

RESUME. I may say that the prognosis of chronic valvular disease of the heart in private practice is much better, both as to duration and capacity for work, than most persons realize. It is no uncommon experience to find persons who have sustained these lesions for ten, fifteen, and twenty years, in some cases much longer, without either great discomfort or great impairment of their activity. The patients who sustain these lesions longest and with least embarrassment are those of temperate habits and spare build who do not easily become angered or worried and who are controllable as to their mode of life and activities. Those who can lead a quiet, sheltered, protected life naturally live the longest. When death occurs it is usually the result of some accident or intercurrent disease, not directly from the heart.

In estimating the prognosis in a particular case one needs to keep in mind the distinction between a heart lesion and heart disease. As long as there is only a lesion the prognosis is good. A lesion ceases to exist and disease sets in when the heart enlarges and subjective symptoms appear. In my opinion subjective symptoms are better guides to the functional energy of the heart and to its lasting power than are objective signs.

In angina pectoris the duration may be five years instead of the conventional one or two, just as some cases of aortic insufficiency may, under favorable conditions, last for thirty or forty years instead of the ten years which Clifford Allbutt says is the average.

INTESTINAL OBSTRUCTION.[1]

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I PRESENT to you today a study of the general subject of intestinal obstruction, with deductions drawn from an analysis of 52 of my private cases taken in succession. The subject will be treated from a diagnostic standpoint, for early and correct diagnosis is still the most urgent need in the treatment of these grave cases. Certain conditions not generally included under the heading of intestinal obstruction are considered, since the total or partial occlusion of some part of the digestive tract was a prominent clinical feature. Many cases of septic peritonitis and similar conditions involving motor paralysis have been noted meanwhile, but are not included in this report.

Of the 52 cases, 29 were males, 23 females; 14 of these were in the fifth decade, 12 in the third, 8 in the fourth, 8 in the first, 7 in the sixth, none in the second; 33 of the patients were operated upon, and 2 others explored, by different surgeons of Colorado, while the diagnosis was established by postmortem examination in 5 other cases. In Case XXXIV the diagnosis was rendered certain by the projection of the intussuscepted bowel through the anus, operation being refused. In 11 cases the evidence as to the cause of the obstruction was clinical rather than anatomical. In 3 of these acute dilatation of the stomach existed, the obstruction being relieved by postural treatment in 2, after continuous fecal vomiting had existed in one for forty-eight hours and non-fecal vomiting in another for the same time. The third patient died unrelieved.

In 3 cases septic paresis of the bowel was regarded as the cause, 1 dying. In 1 case impaction resulted from chronic appendicitis; in 1, impaction of the sigmoid from unknown cause; in 1, motor paralysis from acute pneumonia with diaphragmatic pleurisy; and in 1, paralysis from inflammation about tuberculous glands palpable in the abdomen, all 4 recovering without operation. The last case died from obstruction, associated with the presence of an immense malignant growth in the abdomen of unknown origin, no post-mortem being permitted.

There were in this series 12 cases definitely due to bands or adhesions from previous operation, and 9 not so caused, a total of 21 out of 52 cases. The previous operations were performed for appendicitis five times, pelvic tumor three times, previous obstruction twice, gall-bladder disease and gastro-enterostomy for ulcer,

[1] Read at a meeting of the Montana State Medical Society, Hot Sulphur Springs, May 12, 1910.

each once. The bands or adhesions in the 9 cases not previously operated upon were found to be due to former appendicitis in 6 cases, to pyloric ulcer and tuberculous peritonitis in 1 case each, while 1 case due to an omental band was probably congenital. Obstruction from cancer took second rank—6 cases—in three instances being in the colon, in 2 in the mesentery, and in 1 the exact location was not learned, a large tumor filling the abdomen.

Tuberculous peritonitis caused obstruction in 4 cases, acute dilatation of the stomach (see explanation below) in 3 cases, intussusception in 3 cases, congenital dilatation of the colon in 2 cases, twist in 2 cases, Treitz's hernia in 2 cases, thrombosis of the mesenteric vessels in 2 cases, septic paresis in 3 cases, general adhesive peritonitis, congenital dilatation of the small intestine, congenital pyloric stenosis, paresis from diaphragmatic pleurisy in connection with penumonia, and impaction in the sigmoid from unknown cause, in each, 1 case.

More than one cause of possible obstruction was present in 5 cases, each being listed above according to the most active agency in producing the obstruction. The complications were: Acute obstruction by bands from old appendicitis, with 4 partial constrictions from tuberculous ulcers also present (operation by Dr. Lyman, recovery); acute obstruction from a band at the site of previous appendicitis and a cancer of the colon on the opposite side of the abdomen, not fully blocking the bowel (operated by Dr. Harris); obstruction from a band from previous operation and congenital small colon dragged down into a V shape (operated by Dr. Lyman, with complete recovery); twist coming on while skipping rope, accompanied by acute tuberculous peritonitis (operated by Dr. Perkins, with recovery from both conditions); obstruction by congenital omental band, Meckel's diverticulum giving opportunity for obstruction, but apparently taking no part in this attack.

In 3 cases the patient had shortly before been made very ill by eating some food disagreeing with the digestive organs, adhesions from recent appendicitis, thrombosis of the superior mesenteric artery, and twist affecting the small bowel being the cause of obstruction in the respective cases. In the first 2 I regarded the food poisoning as the remote cause of the obstruction.

In Case II the congenitally small colon was probably the cause of the operation for obstruction twelve years previously, which operation in turn had caused obstruction by a band.

Case XV was operated upon for appendicitis five years ago, and afterward under my care had four separate attacks of obstruction due to adhesions, and relieved each time by operation by Dr. Dean; two of these were acute in character. She is counted but once in this report.

Of the operated cases, 21 recovered from the obstruction, 1 subsequently dying of uremia. Of the non-operative cases, 8 recovered,

1 subsequently dying of acute pneumonia. Of cases operated upon, 12 died, and also 2 cases in which exploration only was made, hopeless cancer being found, the death being due to the gradual development of the growth. Of the 21 cases operated upon which recovered and the 8 cases recovering without operation, 29 in all, we need say but little here. Let us study the 12 cases operated upon and the 2 explored which were lost, and the 9 cases dying without operation, to see if better results could have been obtained under ideal conditions.

Case VII had been injured in a runaway twenty-four years before, with resulting obstruction, relieved by operation twelve years later. Dr. Wetherill, in the second obstruction, divided constricting bands which had reformed, with relief to the obstruction, but the man died of uremic coma. Probably no better result could be hoped for, for the operation was performed as soon as the obstruction was fully declared, and especial care was taken with the anesthesia because of the presence of albumin and casts.

Case IX was poisoned by eating white fish preserved with formalin, some of the layers of the fish being recognizable in the vomitus on the eighth day. The obstruction came on the ninth day, and was found to be due to thrombosis of the superior mesenteric artery, requiring resection of thirty-six inches of small intestine. In his weakened condition after nine days of vomiting and purging, probably nothing could possibly have saved him. We did not, of course, know of the desperate nature of the trouble before the exploration.

Case II had a twist of the small intestine, and did well until pulmonary embolism occurred, a contingency we cannot guard against. Case XIII was that of a rapidly developing cancer of the colon with acute obstruction, promptly relieved by excision. The operation was necessarily extensive. Death occurred from perforation after several days. The operation was performed by a surgeon of great experience and good judgment, and I believe no better result could have been attained under the circumstances. Case XXXV was a duplicate of the last case in a girl, aged twenty-one years, in the hands of another surgeon equally experienced. Death resulted from the same cause. Case XVI was promptly operated upon, and five separate points of more or less complete obstruction were found resulting apparently from a previous pyloric ulcer, and the operation was, of course, a tedious one. The patient died of shock.

Case XXIV was relieved of the obstruction by a band from a former appendicitis, but died from the shock of a prolonged operation for the removal of a cancer of the colon on the opposite side of the abdomen and which had no part in the obstruction. It was not even suspected until the surgeon felt it in examining the abdomen before closing up the wound after relieving the obstruction. These

cases are always desperate. Case XXVII was the first one of this list that offered a reasonable hope of recovery, but he came to our attention only after eighteen inches of small bowel had become gangrenous from intussusception, and died from the shock of the operation. Earlier diagnosis and operation would probably have saved his life. Case XXXVII had obstruction from an omental band, but was likewise seen too late. Case XL was one of the rare instances of chronic adhesive peritonitis, always fatal so far as I know.

In Case XLI a definite history of ulcer with hematemesis occurring ten years previously was obtained, with normal health until one year before operation. I diagnosticated the scar of a past ulcer not obstructing the pylorus, and an active ulcer at the pylorus with complete obstruction, the latter half of the diagnosis being based upon the obstruction, pain, high gastric acidity, and recent hematemesis with the previously clear history of ulcer. A scar two inches long was found about three inches from the pylorus on the anterior wall, but instead of an ulcer at the pylorus, Dr. Freeman found a small Treitz's hernia with absolute obstruction of the duodenum. The patient did not survive the operation. From the intermittency of the symptoms I believe I should have avoided the erroneous diagnosis of pyloric ulcer, and diagnosticated some intermittent strangulation, though the exact cause was probably not possible of diagnosis.

Case XLIV was one of congenital pyloric stenosis, promptly diagnosticated and operated upon almost immediately by Dr. Lyman on the third day of life; a gastro-enterostomy being performed. The baby died of shock. I do not believe it could have been saved by any method of treatment. Case XLVI was one of Treitz's hernia, the sac containing practically the entire small bowel and the cecum. Gangrene had already occurred before Dr. Freeman was called—another example of unnecessary delay, with death as a result. Cases XLIX and LI were explored and hopeless cancer found—no attempt at relief of the obstruction being possible. Of the cases dying without operation, one baby (Case XXXIV), with intussusception, should have been saved, but operation was refused. Case VI was an imbecile with some type of septic peritonitis causing complete obstruction, and was moribund when seen. Earlier diagnosis should have saved him.

Case XVIII had intermitting obstruction from a band from former appendicitis. Although a physician, he absolutely refused operation. He should have been saved.

Case XXI had thrombosis of the superior mesenteric artery due to syphilitic endarteritis. He was then recovering from syphilitic hemiplegia, and his general condition was so bad that Dr. Freeman and I decided it best not to attempt operation. The autopsy confirmed us in this view of the case. Case XXIII was obviously

a hopeless cancerous mass in the abdomen. Case XXXIII was that of a child, aged eleven weeks, with enormous congenital dilatation of the small bowel with transverse "steps" distinctly shown in the abdominal wall. After seeing the postmortem examination I was confirmed in my view of the utter hopelessness of relief. Case XXXVI had cancer of the mesentery, proved by autopsy to have been utterly inoperable. Case XLVIII had obstruction from the so-called acute dilatation of the stomach, but died from associated aspiration pneumonia. Case LII was one of congenital dilatation of the colon, having, like Case XXXIII, transverse furrows across the abdomen, leading me to make an erroneous diagnosis of dilatation of the smaller bowel. Two feet of the latter were so affected, but the main trouble lay in the colon.

Thus, of the 23 cases lost, 7 had cancerous disease and were practically hopeless from the start. The fatal results in the 2 cases of congenital dilatation of the intestine and those with syphilitic arteritis, uremia, ptomaine poisoning, pulmonary embolism, chronic adhesive peritonitis, and aspiration pneumonia were unavoidable from our standpoint. One of the cases of Treitz's hernia and the congenital pyloric stenosis were on the borderline with the chances against success. Two could probably have been saved if operation had been accepted when offered, and 4 more if seen earlier. Considering the desperate nature of the condition I are studying, I feel that the results obtained are a great tribute to the skill of the surgeons with whom I am associated. Practically, the only way in which the mortality could have been decreased in this series of cases would have been in earlier diagnosis and earlier operation.

Much has been written of acute dilatation of the stomach, yet many of the cases are so ill-defined as to pass unrecognized. The typical vomiting of large quantities of fluid was present in but 1 of the 3 cases quoted. In the other 2 gas was present in the stomach in abundance, but only small quantities of fluid were vomited. The relief of these 2 cases by turning them on the abdomen, with the idea of lessening the constriction of the duodenum by the drag of the mesenteric vessels through the postural change (as suggested in the first one by Dr. Freeman), was very striking.

Case L, of congenital dilatation of the colon, had previously gone ninety days without a stool, and passed forty-five pounds of feces when finally relieved. The baby, aged one year, with a similar condition promised nothing from operation, and died unrelieved.

We should all watch carefully for the cases of threatening obstruction from sagging of the transverse colon. The trouble is so easily demonstrated by the bismuth injection and the *x*-rays, and relief appears so promising from recently introduced operative procedures, that they should be much less troublesome than they have been hitherto. In several cases that I have seen which fell short

of complete obstruction the relief by fixation in a better position has been very satisfactory, and anastomotic operations promise still more complete relief. No case of obstruction by Meckel's diverticulum nor by gallstone or other foreign body occurred in this series, nor was any observed following concussion of the abdominal wall.

Careful inquiry and physical examination will generally enable us to avoid opening the abdomen in cases of obstruction associated with pneumonia and that occasionally seen in nephritis. In one case of incomplete obstruction not included in this list the development of erythematous and urticarial lesions, hemorrhage from the kidneys, ecchymosis and joint pains decided us against operation, the case being a typical one of erythema with visceral lesions. It fully recovered in a few days under medical treatment.

While studying this series, Dr. H. L. Taylor found it necessary to operate upon one case of obstruction in lead poisoning. He found the small bowel so firmly contracted in certain sections that it was practically a solid cord, and no other cause of obstruction could be found. The patient recovered under purgatives. Such a possibility should be more widely recognized.

The mortality of 767 cases of acute obstruction gathered by Scudder from Willms' compilation, and operated upon by fourteen of the foremost surgeons of Europe, was 351, or slightly less than 46 per cent. Of the 121 cases occurring in the Massachusets General Hospital, and reported by Scudder, the mortality was 60 per cent.; 33 of our cases were actually operated upon (2 were simply explored), and to make our statistics comparable with those given above 6 are thrown out because of being subacute or chronic obstructions. One case was operated upon twice for recurring acute obstruction, and is counted but once in the list, so that there were in all 28 operations for acute obstruction, with a total of 14 recovering—a mortality of 50 per cent.

Many investigators have studied the varying effects of obstruction at different points in the intestinal canal, and the summary of their views by Scudder presents the subject well. For the diagnostician the important deductions are as given below:

Obstruction is more acute and more dangerous according as its location is higher in the canal. Maury seems to have demonstrated that the earlier mortality in high duodenojejunal obstruction may be due to the absorption of certain biliary poisons normally diluted and suspended in the secretions of the bowel, but in case of obstruction, held and absorbed.

Obstruction does harm because of the infection taking place rather than from its purely mechanical features (Reichel). The paralysis of the wall of the gut, absorption of toxic material, accumulation of gas, pressure effects from this and the associated congestion, blocking of the intestinal circulation, gangrene, perforation,

and death are all dependent upon infection. A general septicemia, in which the colon bacillus takes the most prominent part, is often the final cause of death. The permeability of the wall of the infected loop to bacteria is an important factor, but a poisoning by bacterial toxins may be present without such permeation of bacteria into the peritoneal cavity.

If life is to be saved the advance of pathological processes in the bowel must be averted by early operation. If we could be certain of the obstruction early enough in the case, and have the patient operated upon at once by a competent surgeon, the death rate could be nearly wiped out. Delay comes from non-recognition of the early signs of the obstruction, and hesitation because of fear that the abdomen may be opened unnecessarily. As in so many acute abdominal conditions the physician is so anxious to be absolutely certain of his ground that he too often waits for the advent of marked shock, fecal vomiting, and extreme distention. These mark, not the earliest time for surgical intervention, but the time of such advanced destructive lesions as render the operation one of great danger.

I think every one dealing extensively with acute abdominal disease finds that he recommends operation earlier and upon less absolutely certain signs as his experience increases. The physician's responsibility lies largely in excluding what we might term medical causes for obstruction, such as we may see in uremia, pneumonia, diaphragmatic pleurisy, erythema with visceral lesions, etc. If these be excluded, the surgeon should be called without sacrificing too much time in the attempt to make an exact diagnosis; we should rather take the position of advising operation in any case in which our suspicions of a beginning acute obstruction cannot be set aside by the most careful consideration of all features of the case, than of waiting until we are absolutely certain it has taken place. The price of certainty is too often death, and ten deaths occur from waiting too long where one case is damaged by too early intervention. I have never yet seen the abdomen opened for obstruction without finding abundant justification for the operation. Even cases in which advanced cancer is found should have a chance for recovery if operation can give it to them. A lingering death with fecal vomiting as a termination is so horrible that any reasonable attempt to avoid it even by an operation of great risk should be carefully considered.

The occurrence of sudden abdominal pain, followed by cessation of bowel movement, without material rise in temperature, but with increasing frequency of the pulse, with abdominal distention, often local in the affected loop of bowel (Wahl's sign), and accompanied by visible peristalsis, often with nausea and vomiting, and without the tenderness and involuntary rigidity seen so typically in acute appendiceal, gall-bladder, and stomach lesions, should

suggest acute intestinal obstruction with so much probability that we should avoid opiates if possible, withhold all food, and all cathartics by the mouth, and attempt to relieve the obstruction by enemas. At this time, as Ewald has shown, the stomach contains matter regurgitated by reverse peristalsis from the upper bowel, and the stomach washings should be watched for the first appearance of fecal odor.

Obstructions high up in the canal are generally characterized by greater pain, earlier nausea and vomiting, more flattening of the abdomen, scanty urine, and earlier collapse. Low obstructions are characterized by greater abdominal distention, oftentimes with prominence of certain portions of the abdomen, indicating that the entire colon is distended, or only certain portions of it, or only the small bowel. The prominence of a "horseshoe" of distended bowel in the course of the colon is very striking evidence of obstruction low down, while the absence of this and the presence of smaller prominent loops in the central abdomen suggests that the lower small bowel or cecum is affected. Previous operation suggests obstruction by bands or adhesions. A history of gallstone disease suggests the possibility of obstruction by a large stone escaped by ulceration into the bowel. In the insane we think of obstruction through foreign bodies swallowed. In patients with diarrhœal and dysenteric diseases the possibility of obstruction through masses of bismnth or other insoluble medicament is present.

The presence of blood in the stools and a tumor in the abdomen in a young patient with obstruction of sudden onset suggests intussusception.

The beginning of the trouble after such exercise as skipping rope and certain contortions indulged in by boys in the gymnasium suggests a twist. A tuberculous history and the presence of palpable glands suggest obstruction by an acute process connected with a tuberculous peritonitis. A history of typhoid fever, duodenal ulcer, syphilis, or dysentery suggests a gradually contracting cicatrix with a sudden obstruction at the end. Gradual loss of weight and enlargement of accessory glands speak for cancer. Syphilis and toxemic conditions suggest the possibility of mesenteric thrombosis, and serious valvular disease and endocarditis the chance for mesenteric embolism. Blood is generally present in the stools in this class of cases, and was freely vomited in Case XX of my series.

Obstruction without any definite localizing or diagnostic signs speaks in general for some type of obstruction secondary to interference with the circulation of the gut, as from thrombosis or cancer of the mesentery. Obstruction from chronic intussusception is difficult of diagnosis unless the tumor be found. An indefinite obstruction with prominent tumor may be found in volvulus of the omentum.

Rectal examination, investigation of the urine for indicanuria, of the blood for leukocytosis, a well-kept record of pulse and temperature, careful physical examination of the chest, and, in general, the utmost watchfulness should be employed. The mortality will probably be less in the future, as the imperative need of early diagnosis and operation are better appreciated.

I am under obligations to Drs. Cochems, Craig, Dean, Fleming, Freeman, Harris, Lyman, Taylor, Tennant, Wetherill, and Williams, with whom I saw the cases reported, and to Dr. Love for the compilation of the histories.

IDIOPATHIC CIRCUMSCRIBED SPINAL SEROUS MENINGITIS.

WITH THE REPORT OF A SUCCESSFUL OPERATIVE CASE.

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Circumscribed spinal serous meningitis as a distinct disease, has been generally recognized only since 1903, although it was previously described by Schlesinger[1] in 1898, who found such a condition at necropsy. Since then cases have been recorded by Krause[2] and Oppenheim,[3] Bruns,[4] de Montet,[5] Mendel and Adler,[6] and others, and by Horsley,[7] who in February, 1909, described 21 cases. In this country the first report was made by Spiller,[8] who in 1903 recorded a successful operative case, reporting it at that time as a cyst in the pia-arachnoid. Since then Bliss[9] has reported one case and Munro six. It is probable, however, that other surgeons and neurologists have observed this condition, but did not recognize it. This was the experience of Munro.[10]

It is of the utmost importance to recognize clinically circumscribed spinal serous meningitis, inasmuch as an early operation

[1] Beit. z. Kennt. d. Rückenm. und Wirbeltumoren, Jena, 1898.

[2] Verhandl. d. Gesell. Deut. Naturf., 1906, ii Theil, p. 194; Berl. klin. Woch., 1906, p. 827; Verhandl. d. deut. Gesell. f. Chir., 1907, ii Theil, p. 598; Deut. Zeitschr. f. Nervenheilk., 1908.

[3] Mittheil. aus d. Grenzgeb., 1906, p. 607; Verhand. d. Gesell. Deut Naturf., 1906, ii Theil, p. 194; Beit. z. Diag. und Therap. d. Geschw. d. central Nerv. System, Berlin, 1907

[4] Berl. klin. Woch., 1908, p. 1753.

[5] Cor.-Bl. f. Schweiz. Aerzte, 1908, p. 698.

[6] Berl. klin. Woch., 1908, p. 1596.

[7] Brit. Med. Jour., February, 1909.

[8] Univ. Penn. Med. Bull., 1903.

[9] Jour. Amer. Med. Assoc., March, 1909.

[10] Surgery, Gynecology, and Obstetrics, March, 1910, pp. 235 to 244.

offers prompt relief. So far in all the reported cases the diagnosis of tumor of the spinal cord has been made, and while operation on spinal cord tumors is not always urged, there is no doubt that were this condition promptly recognized operations would be immediately done. It has been asserted that it is impossible to make a differential diagnosis between spinal cord tumor and circumscribed serous meningitis, but we are of the opinion that with the added knowledge which all well-recorded cases give, such a diagnosis can be made, although in our case, as in all of the others, it was not done. One reason for this is the fact that every case in which there is found an excess of fluid at operation is called a serous meningitis, and this should be expected in any newly recognized disease when it is also considered that little is known of its pathology.

PATHOLOGY. Most of our knowledge has been gained from the operative cases and from a few which have come to necropsy. At operations, as in our case, the dura is tense, as if under great pressure, and there is very little or no pulsation and it generally appears bluish and congested. When the dura is opened, as so well described by Munro, a small quantity of cerebrospinal fluid escapes under slight pressure, while immediately the dural slit is filled by a thin, more or less opaque pial membrane that bulges forth under tension of the contained fluid. This fluid is clear and spurts forth as soon as the membrane is opened, when the latter flaps back and forth as a definite curtain attached to the dura and cord and more or less to the nerve roots.

The spinal fluid was examined in one case by de Montet, who obtained it by lumbar puncture, and found many lymphocytes and leukocytes, both being of the same percentage, and large mononuclear cells which resembled large phagocytes. There were no plasma cells or bacteria.

In the cases with necropsy there has been found nearly always some inflammation of the meninges and less often of the cord. Horsley in two cases found tabes and meningogliosis, while others have described tuberculous disease of the vertebræ, meningitis, either tuberculous or syphilitic, syringomyelia, and diffuse sclerosis of the cord. Horsley, who has had the most extensive experience, states that in every case in which he operated, after the escape of the fluid the cord presented a shrunken appearance and a slight yellowish tinge, and he further states that he never operated upon an early case, excepting in one in which the matting of the arachnoid precluded examination of the cord.

There is no question, however, that circumscribed serous meningitis can occur either without disease of the cord or of further disease of the meninges. In our case, after the evacuation of the fluid the cord appeared slightly congested, but was otherwise normal. More important still, every symptom promptly disappeared, as

has been demonstrated by repeated examinations. Such is also the opinion of Bruns, who, in re-recording his case two years after operation, states that most of the symptoms have disappeared, and he believes that there was present no other pathological condition. In reviewing the literature, Bruns was of the opinion that only the cases of Spiller, Mendel and Adler, and one of Krause, besides his own, were examples of idiopathic circumscribed spinal serous meningitis, and he emphasizes the fact that such a condition is possible contrary to the opinion of Oppenheim, who believes that this must be taken guardedly and we should always look for an accompanying intramedullary process. Mendel and Adler were also doubtful as to their case, and thought that it may have been the result of an accompanying tuberculosis. They quote, however, Ströbe, who expressed the opinion in 1903 that idiopathic circumscribed serous meningitis may exist.

Since Bruns' report other cases have been recorded. Of these, de Montet's case is the only one which seems not to have been accompanied by other processes. None of Munro's cases were idiopathic, and Bliss subsequently found a tumor. Horsley states that in all the cases which he operated upon there was present a certain amount of pachymeningitis or gliosis of the cord, but, nevertheless, he is of the opinion that a meningitis alone might have been the sole cause in some of his cases.

Etiology. Traumatism was undoubtedly the cause of the meningitis in our case, inasmuch as it followed a very severe fall over the right hip and buttock. Similar instances have been recorded by Munro and Bliss, although they were not of the idiopathic type. Oppenheim believes that such a condition is not a sequel of concussion or so-called railway spine. Horsley mentions influenza and gonorrhœa as causes. As has already been stated it occurs in the majority of cases with associated spinal or meningeal diseases.

Little is known of its development, but it is probably due to disease of the pia-arachnoid, which leads, according to Krause, to the formation of adhesions and increased exudation with lessened power of absorption of the secreted fluid in the diseased area. With this there is exerted pressure on the cord and there are also produced vascular changes, this explaining the onset of the symptoms. It is also to be remembered that most of the cysts described have occurred in the posterior part of the cord.

Symptoms. As has already been stated, they resemble almost exactly those of tumor. From the very nature of the growth, however, the symptoms produced by a cyst should differ from those of a hard growth, such as a sarcoma. A cyst, first of all, produces slower developing symptoms, inasmuch as its pressure is more diffuse; and secondly, its symptoms should be of wider range, because in most instances it will be larger than a tumor.

Of course, in those cases in which the cysts are small no differentiation is possible.

As has been indicated by Horsley, the symptoms first point to unilateral involvement, but in the later stages they will be bilateral. Inasmuch as most cysts are in the posterior part of the cord the principal symptoms will be sensory. These are first irritative, and are generally described as a hot, burning, tingling sensation, which, as in our case, may be limited to a root distribution and later become diffuse over the whole limb. Horsley, however, seems to be of the opinion that the pains are never localized to a root distribution, and he considers this one of the most valuable of the minutiæ which serve to distinguish this disease from tumor.

Another important symptom which Horsley considers to be present only in serous meningitis is a hyperesthesia which sometimes is present over the whole limb, and he considers this the result of irritation of the roots. This was present also in our case, but was limited over the anesthetic areas, in the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots. Another interesting fact was that while touch, pain, and temperature sense were absent over these parts, deep pressure elicited pain, this being present in no other part of the limb. It may have been that there is a relation between the hyperesthesia and the presence of pain on deep palpation, but in the subsequent development of anesthesia upon the other side there was present neither hyperesthesia nor the deep pain. It is an interesting confirmation of Head's observations, and shows that even in the spinal roots deep sensation is transmitted by a different set of fibers.

While pain and paresthesias of various sorts are always present in circumscribed serous meningitis, there may or may not be loss of sensation. Horsley states that in no case has he seen absolute tactile anesthesia, and that it always was relative and sometimes present only to a slight degree and extended over a large area. In our case there was a sharply defined anesthesia for touch, pain, and temperature over the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots on one side, later becoming bilateral, and an indefinite relative disturbance for all forms in the rest of the limbs. It is interesting to observe that in the examinations that were made almost daily there were variations of the limits of the anesthesia. De Montet found a similar condition. It must, however, be remembered that there may be variations in the limits of anesthesia in tumor, and that this does not form an absolute diagnostic symptom. It is also interesting to observe that in our case, while the pains and anesthesia varied in different examinations, the upper limits in both were never disturbed and that the variations were always in the lateral and lower parts.

Horsley states that in no case has he observed vasomotor symp-

toms. In our case the right thigh was swollen and the skin did not react to stimulation as well as the left. Just before the operation the patient developed trophic phenomena, consisting of a bluish-red condition of the inner parts of both large toes.

Motor symptoms in some form are always present. They consist of weakness of one limb and later of both, and generally come on slowly, although sudden paralysis sometimes occurs. Munro mentions that in one of his cases the paralysis at times was spastic and then again flaccid. This was also true of our case. In Bruns' case there was an atrophic muscular paralysis, evidently the result of anterior root involvement, besides the symptoms of sympathetic paralysis, such as myosis and narrowing of the palpebral fissure. There was also ataxia in one limb.

The reflexes are generally increased, and there may be patellar or ankle clonus and sometimes a Babinski sign. One interesting fact about our case was that the reflexes varied on different examinations. While at times there would be a great exaggeration of the patellar and Achilles jerks, in the very next examination there would be great diminution or even loss. This variation is mentioned also by Munro and especially by Bruns, who particularly states that several symptoms, such as the pupillary, the reflexes, including in this the Achilles clonus and Babinski, as well as the ataxia and even the gait, were altered on different examinations. He, however, observed this condition after the operation.

For a month before the operation our patient had increased frequency of urination, but there was no disturbance of rectal function. In a number of the reported cases incontinence of urine and feces is mentioned. The patient had great tenderness over the vertebræ, especially over the lower dorsal and lumbar area, the tenderness becoming more marked from above downward. There was, besides, pain on every movement of the vertebræ. Surgically, the patient made an excellent recovery, and at the present time, seven months after the operation, is totally well. Careful examination made several days after the operation demonstrated no symptoms, and she has not complained of paresthesia or pain. In fact, all of her symptoms promptly disappeared. So far as we know this is one of the most successful cases reported, for in all of them instead of a sudden disappearance of symptoms there was a gradual alleviation.

It is unnecessary to urge an early operation, for it is sufficient to mention that Horsley has one patient who is living and well, and who was operated upon ten years previously.

Finally, we believe that the important point upon which a diagnosis can be made of circumscribed serous meningitis is the variability of the sensory and motor symptoms in consecutive examinations. These are, in short:

1. *Sensory:* (*a*) Pains of a numb, burning character in part or all of a limb which vary from day to day in their distribution, and (*b*) disturbance of sensation which may or may not be absolute, the limits of which vary.

2. *Motor:* (*a*) Weakness generally appearing in one limb and later in both, which may be spastic or flaccid on different examinations, and (*b*) variability in reflexes which may be increased or diminished in consecutive examinations.

The history of the case is as follows:

Dorothy, aged twenty years, single. Family and past history are negative. Two years before she came under observation, while skating, the patient fell and struck her right hip and buttock, this causing some discomfort for several days. About one year afterward she began to complain of a burning, tingling, numb feeling over the anterior and inner portion of the right thigh. The severity of these sensations gradually increased until they became quite marked, and she also complained of them over the whole of the right thigh and buttock. She also noticed that the skin over these parts was sensitive and that the pressure of clothes irritated them. It was not until about two months before she came under our observation, or one year after the beginning of her pains, that she developed a constant aching feeling over the lower portion of her back, especially of the right side, and in the right hip and thigh. The whole right limb now became numb and she complained fo a constant aching, dead, or tired feeling, but all this time the burning, hot, and tingling sensations persisted over the anterior and inner portion of the right thigh and hip.

Coincident with the onset of the more severe pains the right limb became a little weak, inasmuch as she tired very easily, and she had to favor this limb when walking; and about one month before she came under observation she could not cross the right limb over the left as well as formerly. At the same time she observed that the right thigh was swollen as compared with the left.

She came under our observation February 19, 1910, when the above history was obtained. Examination demonstrated an area of total loss of sensation for pain, touch, and temperature over the distribution of the eleventh and twelfth thoracic and first, second, and third lumbar roots on the right side, according to the sensory charts of Starr. There was besides an ill-defined disturbance of sensation over the whole right limb and over that part of the buttock which is not included in the above area. This was especially marked for pain sensation. That part of the thigh, abdomen, and buttock in which there was loss of sensation for touch, pain, and temperature was tender to pressure, whereas the other parts of the limb, in which sensation was only partly disturbed, were not. She also at this time complained of the pressure of her clothes,

stating that they hurt her, and that she practically felt no paresthesia at all with her clothes off, especially when minus her corset.

Examination of the thigh showed an apparent swelling over the upper and middle portions, it measuring one inch more than the left. Stroking the skin produced a white mark, this showing a disturbance of circulation, it not being present on the left. There was a decided weakness in flexing the thigh on the abdomen and in abduction and adduction of the thigh. Movements of the leg upon the thigh were fairly well performed, although there was manifestly some weakness. Every movement of the right leg, whether voluntary or against resistance, caused pain in the right thigh and hip. Both patellar jerks were prompter than normal, the right more so, and there was present an abortive ankle clonus on the right side. There was no disturbance of the bladder and rectal functions or of menstruation.

At the above examination the diagnosis was made of a spinal cord tumor, and she was operated upon about three weeks after the first examination, being examined quite frequently in the interim. In the second examination, which was made one week afterward, the pain had become more severe, and at this time she complained, of a constant hot and burning feeling in the whole right limb and somewhat in the left limb. Examination for sensation demonstrated that the limits of the absolute loss of sensation which were found in the previous examination were widened, but the upper limit was just as it was in the previous examination. It was also found that sensation was markedly disturbed over the whole left limb in a manner similar to the right and that there was a total loss of sensation over the distributions of the eleventh and twelfth thoracic and first, second, and third lumbar roots, the loss of sensation being almost as great as in the first examination on the right side. The pain on the left, however, was not as marked as it was over the right, and there was not present the soreness on pressure or the hyperesthesia on touching the skin which was a prominent symptom on the right side. Subsequent sensory examinations nearly always demonstrated total loss of sensation over the eleventh and twelfth thoracic and first, second, and third lumbar root distributions over both sides, the lateral and lower limits changing, however, but the upper limits were always constant and never varied.

Examination of the back did not demonstrate any curvature, but there was a marked tenderness to pressure over the vertebræ, which began over the eighth thoracic and became progressively more marked over the lumbar and especially over the sacral vertebræ, and was equal on both sides. Lateral movement of the body always elicited pain in the back and especially over the sacrum.

Two weeks before she was operated upon there was a beginning increase in the frequency of urination, but the rectal functions were never impaired. It was also noticed that the inner part of

the right toe became bluish and that both feet were cold. There was at no time loss of power in the left limb. In the two weeks preceding the operation the reflexes on both sides were mostly exaggerated and there was occasionally an abortive ankle clonus on both sides. At no time was there a Babinski sign on either side, the reactions on the left side being always in flexion, while on the right plantar irritation occasionally produced no movement of the toes. It was always noticeable that while the tendon reflexes were nearly always prompt, their degree varied, and on a number of occasions the patellar and Achilles jerks could not be obtained, while in the following examination they would be much exaggerated and a small ankle clonus present.

The operation was performed by Dr. George P. Müller, on March 16, 1910. A vertical incision, about five inches long, was made in the median line, with its centre over the tenth spinous process. The incision was deepened on either side of the posterior spines and the soft parts cleared away from the spines and laminæ of the eighth to the eleventh vertebræ. There was not much oozing, and such hemorrhage as occurred was easily controlled by gauze packing wrung out of hot normal salt solution. The posterior spinous processes of the ninth, tenth, and eleventh vertebræ were then removed with bone forceps, and the spinal canal opened with rongeur forceps. After separating the posterior fat, the spinal cord was exposed and seemed to be palpating distinctly, rather congested in appearance, and tense, but not excessively so. A separator introduced above and below the operative field failed to detect any mass or adhesions. A small niche was made in the dura in the median line posteriorly and over the tenth vertebra, a thin membrane forcibly bulged into the wound in the dura, and despite precautions to avoid puncturing this it was opened during the enlarging of the dural wound upward. An immediate gush of clear cerebrospinal fluid occurred, at first forcibly issuing in a jet which was thought to be about one or two inches in height, and subsequently running steadily from the opening, filling the wound and amounting to three or four ounces. It was then seen that the cord was slightly congested, and the remains of the cyst were represented by thin, irregular shreds of tissue; several of these were clipped away with scissors. A separator introduced upward and downward failed to detect any resistance or adhesions, and upon rolling the cord from side to side the anterior roots were observed as being normal. The dura was then closed with a continuous catgut suture, the muscles with interrupted catgut sutures, and the skin with silk. A small drain was introduced at the lower angle of the wound to remove any serum which might collect.

From a surgical standpoint the patient made an uninterrupted recovery, except for the persistence of a sinus discharging cerebrospinal fluid for several weeks after the operation. This sinus

was controlled by elevating the foot of the bed and by a cotton-collodion patch on the back, but would recur again when the bed was lowered and the patch removed. Three weeks after the operation it spontaneously closed. It might be mentioned that urotropin was given throughout the patient's stay in the hospital, no other medicine being required.

DERMATITIS HERPETIFORMIS IN EARLY CHILDHOOD.

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In a careful and exhaustive communication, Knowles[1] recently discussed the occurrence of dermatitis herpetiformis (Duhring[2]) in infancy and childhood. A summary of 57 collected cases showed that a neurotic family tendency usually was present, and that a lowering of the general vitality preceded the onset of the disease in a considerable number of instances.

The most frequent type of eruption was the vesicobullous (a point well illustrated in two of Gardiner's[3] patients), the papulovesicular and pustular forms being less frequently encountered. Grouping of the lesions was not a marked feature, severe itching was seldom present, and subsequent pigmentation of the affected areas was noted in less than one-fourth of the cases. Under the age of four years the disease was comparatively rare, less than a score of instances having been recorded.

The youngest patient whose case has been published is that of Dauchez,[4] the infant being a male, aged ten months, in whom the disease first appeared at the age of two months. In June, 1896, Malcolm Morris[5] exhibited before the Dermatological Society of London an infant, aged thirteen weeks, in whose case a provisional diagnosis of dermatitis herpetiformis was made. Unna[6] has reported two examples of the affection which began in early life, one in a male of twelve years, who had had recurring attacks since infancy, and one in a male of nine years, in whom the disease first appeared at the age of three years. Thilliez's[7] patient was also a male, the skin lesions having first developed when the child was three months old, four months prior to the time of consultation. In the case recorded by Heuss,[8] seen in a male child, aged seventeen

[1] Jour. Cut. Dis., 1907, p. 247.
[2] Jour. Amer. Med. Assoc., August 30, 1884.
[3] Brit. Jour. Dermat., 1909, p. 237.
[4] La France méd., 1897, p. 801.
[5] Brit. Jour. Dermat., 1896, p. 278.
[6] Monats. f. prak. Dermat., August 1, 1889
[7] Thèse de Paris, 1895.
[8] Monats. f. prak. Dermat., 1896, p. 364.

months, the affection had been present, intermittently, for two months. At the time of the report, almost three years later, the manifestations still continued to appear at occasional intervals. Vidal[9] has reported an instance, in a male, aged twenty years, in which the cutaneous lesions were first noted when the patient was five months old. In Barrios'[10] case, which was seen in a female, aged ten years, the disease began at the age of eight months and had persisted for over nine years. Francois[11] reports a similar instance in a female, aged twelve years, the disease having begun when the child was one year of age. Payne's[12] patient was a male of eighteen months, and Kugler's[13] was of the same sex and age. Vanderlinden[14] has recorded the occurrence of the disease in a male, aged two years, the presence of the affection having first been noted five months previously. Jamieson[15] has reported three instances of dermatitis herpetiformis in early childhood, one in a female, aged two years, one in a male, aged two and one-half years, and one in a male, aged eighteen years, the patient having suffered from periodical attacks since his third year. Pringle's[16] case was seen in a male, aged twenty-six months. At a meeting of the Boston Dermatological Society, October, 1904, Bowen[17] exhibited two cases of this disease, one of the patients being a female, aged four years, whose first attack had begun just one year previously. In the ensuing discussion, Dr. Charles J. White[18] spoke of another example of the affection which had been admitted to the skin ward of the Massachusetts General Hospital during Dr. Bowen's service—a male, aged three years; and also of another case, in a female, aged less than three years, that had come into the ward during his own period of service. Later, Bowen, in an article on dermatitis herpetiformis, reported two more cases of the disease occurring in early childhood; both were in females, of the same age—three years.

Durand's[19] patient, a female, aged sixteen years, had suffered from recurring attacks for thirteen years, the initial outbreak having occurred when she was three years old. Roussel's[20] historic case (in which circumcision of the patient was followed by the disappearance of the skin disorder) developed in a male, aged three years. One of Gardiner's[21] patients was a female, aged three years.

During the past nine months I have had under observation a typical example of this affection which began when the patient

[9] Annales de derm. et de syph., 1903, p. 900.
[10] Thèse de Paris, 1900.
[11] Ann. de Soc. de méd. d'Anvers, 1905, lxvii, 3.
[12] Annales de derm. et de syph., 1903, p. 1901.
[13] St. Petersburg. med. Woch., 1905, xxx, 487.
[14] Ann. de Soc. de méd. de Grand 1891, lxx, 15
[15] Edinburgh Med. Jour., 1891, p. 645.
[16] Brit. Jour. Dermat., 1902, p. 304.
[17] Jour. Cut. Dis., 1905, lxxix, 381.
[18] Jour. Cut. Dis., 1905, p. 81.
[19] Jour. des malad. cut. et syph., 1898, x, 533.
[20] New Orleans Med. and Surg. Jour., 1900, p. 722
[21] Loc. cit.

was nine months old, and has continued, with occasional intermissions, for over two and one-half years. I am indebted to my associate, Dr. J. Phillip Kanoky, for the privilege of reporting the case.

C. K., a male, aged three years and six months. The cutaneous history of the family is negative. Both the father and the mother are living and well. A sister of seven and a brother of two years are living and in excellent health. The mother has had no miscarriages.

The patient, who is of Hebrew parentage, was born in Minnesota, but has lived in Kansas City during the past two years. At birth he weighed seven and one-half pounds, and the delivery was normal. He is of a nervous temperament, but his general health has been fairly good. He was circumcised in early infancy. He has had none of the diseases of childhood, and has never been vaccinated.

When the patient was eight and one-half months old the mother, who had nursed him at the breast up to that time, again became pregnant, and it was decided to place the boy on a diet of cow's milk, with some semisolid food. The change did not agree with the child, and he lost weight, became irritable, and slept poorly. Two weeks after the adoption of artificial feeding the mother first noted a "mosquito-bite" (as she expressed it) eruption on the baby's thighs. A lesion would commence as a reddish macule, which was succeeded by a flat-topped papule, at the apex of which one or more tiny vesicles would form. The development was rather slow, the vesicles appearing in about twenty-four hours. The onset was accompanied by some elevation of temperature. A lesion would persist for a week or more, and then gradually disappear, leaving small scars and some pigment. The mother did not know whether or not there was much pruritus present, but the patient was very restless and fretful during this time.

At the beginning there were about a dozen lesions, but new ones developed more rapidly than the old ones disappeared, and during the first exacerbation, which lasted three months, a score or more of the vesicle-capped papules usually were present.

When the child was twelve months old his general health appeared to undergo a considerable amount of improvement; he ate more and slept better, and the eruption, which had gradually become less marked, disappeared altogether. Then followed a quiescent period of twelve weeks, during which the skin was entirely free from active manifestations of the disorder. This was succeeded by a second exacerbation, much milder in character than the first, which lasted five weeks. The parents and the medical attendant (who considered the affection a severe urticaria) could assign no particular reason for the second attack. Since then the eruption has appeared three or four times in each year, and lasted from

two to six weeks following each appearance. Only the trunk and limbs have been attacked, the face, scalp, and mucous membranes always escaping.

Examination. The patient is a well-formed, exceptionally bright boy. He weighs thirty-one pounds, and appears well nourished. The skin of the head and neck apparently is normal, and the tongue and the buccal mucous membrane are unaffected. There are a few dusky brown pigmented spots on the arms, but no recent lesions of any kind are present.

FIG. 1.—Showing the general distribution of the lesions.

FIG. 2.—Groups of vesicles in the lumbar region.

Distributed, in a roughly symmetrical manner, over the trunk and the lower extremities are more than a score of firm, reddish elevations, the tops of which are capped by small, tense, oval vesicles, which vary but little in size and shape (Figs. 1 and 2). There are from three to ten of these minute blisters on each of the elevated areas. The overlying membrane is thick and quite tough. Very few scratch marks are present. Numerous tiny scars can be seen, especially over the lower part of the abdomen, the anterior surfaces of the thighs, and in the sacral region. The pigmentation, also, is more marked in these localities than elsewhere. The palms and

soles are unaffected. There is one recent lesion on the dorsal surface of the right foot. The inguinal glands are enlarged, but are not adherent, and there is no tenderness on manipulation. The thyroid gland cannot be palpated.

The urine is of a rather high specific gravity (1026), and contains a considerable amount of indican (a more or less constant occurrence in this disease, as first pointed out by Engman[22]). Repeated examinations have failed to show the presence of hematoporphyrin, demonstrated in some cases of this affection by McCall Anderson.[23]

The blood findings in dermatitis herpetiformis are always of interest. Funk[24] was the first to note the presence of an eosinophilia in this affection. Roussel[25] found these cells present in the proportion of 30 per cent. In Bowen's[26] case there were 20.5 per cent. at the beginning of the attack, and 4.5 per cent. during quiescence (a state of affairs which he was, I believe, the first to demonstrate in this disorder). Knowles' patient suffered from the vesicobullous type of the disease, the eruption being accompanied by some itching and burning, especially at night, and differential counts showed 33 per cent. of eosinophiles at the acme of the attack and 21 per cent. during the decline of the outbreak. In the blood of our patient we have never found so large a proportion of these cells. When first examined, two weeks after the commencement and about in the middle of a severe attack, there were present 11.5 per cent. of eosinophiles, 62.5 per cent. of polymorphonuclears and 26 per cent. of mononuclears. In the quiescent intervals the average has been slightly greater than 2 per cent.

Permission to do a biopsy has always been refused; consequently no report on tissues can be made.

Itching has been more or less constant, but it has not been sufficiently severe to give rise to much restlessness or loss of sleep.

The treatment adopted in this case deserves a word of explanation. Two years ago my attention was first drawn to the studies of Leopold-Levi and de Rothschild[27] on hypothyroidism in chronic urticaria by a reference in Ravitch's[28] paper. These investigators concluded that the absence, or the functional inactivity, of the thyroid gland was accompanied by a general toxemia, and that the cutaneous lesions develop as a result of this intoxication. The experimental work of Reid Hunt[29] proved that very small amounts of thyroid will protect mice from poisoning by acetonitril.

[22] Jour. Cut. Dis., 1901, p. 358; 1906, p. 216.
[23] Scottish Med. and Surg. Jour., February, 1897, cited by Knowles, loc. cit.
[24] Monats. f. prak. Dermatol., 1893, xvii, 266.
[25] Loc. cit.
[26] Loc. cit.
[27] Compt.-rend. Soc. de biol., November, 1906.
[28] Trans. 6th Inter. Derm. Congress; Jour. Cut. Dis., 1907, p. 512.
[29] Cited by Ravitch, loc. cit.

That a toxic agent of some sort is at times responsible for an attack of dermatitis herpetiformis there can be no doubt, as, for example, in the postvaccination cases of Stelwagon,[30] Pusey,[31] Bowen,[32] and Dyer.[33]

The use of thyroid as a remedy in practically all forms of skin diseases is not new; in fact, some years ago, following the appearance of Bramwell's[34] original communication, the agent was decidedly overused, its employment being, in the vast majority of instances, purely empirical.

Acting upon this theory of Levi-Leopold and de Rothschild, my associate, Dr. Kanoky, and I have employed this remedy in six cases of Duhring's disease in which we thought there was a probability of the presence of hypothyroidism. The fact that marked improvement has followed the administration of the drug in five of the instances makes us feel that thyroid extract is an agent of considerable value in the treatment of selected cases of dermatitis herpetiformis. The results secured were fully as good as one would expect to get from the use of arsenic, quinine, or salicin.

We employ the substance in much smaller doses than are generally advised, seldom giving more than one grain of an active, reliable preparation three times daily, for considerable periods of time. No ill effects have at any time been noted.

Locally, we have found nothing so satisfactory as a lotion containing 5 per cent. of Duhring's[35] compound tincture of mineral tar (tinct. picis mineralis comp.), with powdered calamine and zinc oxide. The patient's general condition should, of course, receive attention, and proper hygiene be maintained. The diet should be carefully regulated. Stimulants and excessive amounts of sweets are especially bad. The case here reported has progressed very favorably under this plan of treatment (the thyroid being administered in one-sixth grain doses), but the period of observation has been too brief for us to judge definitely.

To summarize: This case of dermatitis herpetiformis differs from the majority of those seen in childhood in the character of the eruption (papulovesicular), the presence of scarring (which is probably the result of staphylococcic infection), the development of pigmentation, the absence of lesions on the face, and the early age of the patient at the onset of the disease.

[30] Jour. Amer. Med. Assoc., November 22, 1902; also Diseases of the Skin, 1907, p. 342.
[31] Jour. Cut. Dis., 1897, p. 158.
[32] Ibid., 1904, p. 265; 1905, p. 381.
[33] St. Louis Med. Gaz., 1898; New Orleans Med. and Surg. Jour., xxiv, 211.
[34] Brit. Med. Jour., October 28, 1893.
[35] Amer. Jour. Med. Sci., May, 1894.

RETENTION CYSTS OF THE KIDNEY.

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An obstruction to the outflow of the urine from the pelvis of the kidney, be it partial or complete, gives rise to dilatation of the renal pelvis, and later of the calices. The increased pressure under which the urine is excreted in the presence of continued obstruction will eventually lead to the development of a cystic tumor. These tumors vary in size according to the kind and degree of obstruction and may attain tremendous proportions. If the cystic contents be sterile urine, simple hydronephrosis results. If a hydronephrosis becomes infected and the contents is mixed urine and pus, uropyonephrosis ensues.

Complete obstruction of the ureter never gives rise to as great dilatation of the kidney as does incomplete obstruction. This is due to the resorption through the cystic walls of the continued, although diminished, renal secretion, thus counterbalancing the obstructed outflow; on the other hand, incomplete obstruction cannot injure the parenchyma of the kidney to the extent that a complete obstruction does. The degree of injury will be determined by the time and degree of the obstruction. Further, in incomplete obstruction the pressure on the renal pelvis is less than that which exists in complete obstruction, because the flow of urine will continue, although in a diminished quantity. If the obstruction gradually increases the dilatation will go on until the sac reaches enormous size. Such a tumor may reach into the pelvis and can easily be mistaken for an ovarian cyst.

The obstruction to the urinary outflow may be situated anywhere in the urinary tract from the pelvis of the kidney to the urinary meatus, although the commonest locations are in the ureter or in pelvis of the kidney where it merges into the ureter. They may be congenital or acquired. The congenital obstructions are anomalies of the ureter: (*a*) total absence; (*b*) where the ureter ends in a blind extremity; (*c*) sharp angulation where it leaves the pelvis of the kidney; (*d*) anomalous bloodvessels, causing angulation of the ureters; (*e*) diminution of the ureteral lumen; and (*f*) pressure exerted on the ureter from without, such as tumors, misplaced organs, etc. These congenital defects may exert their baneful influence at any stage of the individual's career, from interuterine life to old age. If the obstruction be relative, one may go through life with a mild degree of hydronephrosis and never have reason to suspect its existence.

Recently at the Germantown Hospital one of my colleagues was called upon to puncture a large cystic abdominal tumor in a fœtus

which rendered delivery impossible. Upon examination it proved to be a hydronephrosis from a congenital obstruction of the ureter.

In acquired hydronephrosis the obstruction may arise from many causes, the four chief ones being: Compression of the ureter, narrowing of the lumen, obstruction of the lumen, and changes in the position of the kidney by which kinking or twisting of the ureter takes place. The greatest number of cases are caused by an inflammatory conditions of the ureter, such as gonorrhœal, tuberculous, or proliferative ureteritis.

Tumors in the pelvic cavity, especially when fixed by adhesions from old peritonitis; retroflexed or fixed uteri; a calculus lodged in the ureter; tumors of the bladder, etc., are not infrequent causes.

It is obvious that ureteral calculus should cause obstruction of the ureter, but this is not always true, for I have on several occasions removed ureteral calculi that have not resulted in permanent dilatation of the kidney pelvis. Tumors of the bladder, when situated at the ureteral orifices can cause obstruction resulting in retention cysts of the kidney.

The following case will serve to illustrate:

Case I.—Mr. R. Bad sexual history. Gonorrhœa many times. He complained of an inability to empty his bladder, with periods of marked exacerbations. The stream would be interrupted, bringing on severe vesical spasms. At times he passed considerable blood. There was no stricture, but he had a chronic posterior urethritis. He gave a history of intermittent pain in his left kidney, but never severe enough to cause remark. He never remembers an attack of pain that could be called a Dietl's crisis. A cystoscopic examination showed a papilloma situated at the left ureteral orifice. This I removed in November, 1908. It was pedunculated, and a large piece of the mucous membrane of the bladder was removed with it. The laboratory reported it as suspicious of malignancy. He returned to the hospital several weeks ago. He had no return of the old bladder symptom and no evidence of the return of the growth. He was, however, very anemic and run down. After a few days in the hospital he developed a severe pain in the left lumbar region, with rise of temperature and chill. There was a large tender mass, which could be easily palpated. The urine showed a little pus and a few red blood cells and a few white cells. His leukocyte count was 33,000 on the first day of the attack and fell in the course of four days to practically normal. A large pyonephritic kidney was removed. There was a small papillomatous growth at the lower side of the pelvis springing from one of the calices, which the laboratory reported as epithelioma. Here was a man with an obstruction at the ureteral orifice, with, I believe, a mild degree of hydronephrosis, which later became infected from below, and became, after years, a pyonephrosis.

Let me relate another experience—a case of mistaken diagnosis,

or at least of only suspected diagnosis, and one that taught me a valuable lesson.

CASE II.—Mrs. W., aged forty-four years, was admitted to the German Hospital August 16, 1909. Family history negative. Had typhoid fever eight years before; otherwise her previous history was negative. In January, 1909, she fell downstairs, since which time she has had constant pain in the right side of her abdomen. Pain was dull at first, but later became sharp and associated with nausea. The pain at times was referred to the right shoulder and at times into the right extremity. She had paroxysmal pain, brought on by standing for some time, which was relieved by lying down. She developed frequent micturition, and lately bloody urine after the attacks of pain. She was nervous, had lost her appetite and considerable weight. I diagnosed nephroptosis and operated upon her. She had a floating kidney, but I did not discover a hydronephrosis which she also had, and here is where I learned my lesson. The reason why I did not diagnose the dilated pelvis was, first, because the pelvis was empty when I exposed the kidney; and second, the patient's doctor told us after all was over that she had had several attacks of hydronephrosis, with typical Dietl's crisis, followed by the passage of a large quantity of urine.

To continue the story—four days after the operation a tumor appeared in the upper right abdomen, most prominent under the right rectus muscle. It fluctuated, moved up and down with each excursion of the diaphragm, and was seemingly connected with the liver. It was somewhat tender. I considered two conditions—cystic enlargement of the gall-bladder from infection, or hydronephrosis. Had I known of the Dietl's crisis I would not have gone wrong. I made an incision through the right rectus, twelve days later, and exposed a large peculiar looking cystic tumor, covered by the peritoneum. It was densely adherent to the stomach, gall-bladder, and transverse colon. Upon tapping, urine escaped, and the diagnosis was at once established. It was removed through an incision made at right angles to the original incision in the rectus muscle. The patient made an uninterrupted recovery.

This was, of course, a case of traumatic hydronephrosis, arising in a movable kidney.

This classification of causes does not include the large number of temporary hydronephroses due to kinking or twisting of the ureter in floating kidney, although, from repeated attacks, the ureter may become strictured and give rise to the more permanent although intermittent hydronephrosis.

In the acquired variety the obstructions of the vesicle orifice, as from hypertrophied prostate, or in the urethra, as stricture or phimosis, do not play an important part in hydronephrosis, for the reason that such an obstruction must exert its effects on both kidneys; and as the effects of double hydronephrosis are quickly fatal, one should be prompt to remove the obstruction.

The symptoms of hydronephrosis vary according to the causes. Intermittent hydronephrosis may be attended by violent acute attacks of pain, which are caused by the distention of the pelvis, and if the pressure continues by distention of the capsule of the kidney. These attacks are more violent if they occur in floating kidney, with twisting or kinking of the ureter, plus twisting of the bloodvessels and consequent active congestion of the parenchyma of the kidney. These symptoms are quickly relieved by removal of the obstruction: there is a greatly increased flow of urine, which will show a lower percentage of solid matter.

On the other hand, the cases of slow formation from incomplete obstruction may give rise to comparatively insignificant symptoms and may be unsuspected until the size of the tumor gives rise to discomfort. The size of the tumor gives rise to a sense of tension and pressure, which is exerted upon the neighboring organs, such as, the large bowel or stomach, with symptoms referable to them. These symptoms are those of dyspepsia, loss of appetite, nausea, eructation of gas, thirst, and constipation. If there be sudden increase in the size of the tumor, pain, due to increased pressure, will be noticed; this pain may be referred to the back or to the genitals.

The large tumors will give rise to fluctuation, and will have a smooth, even surface, while the small hydronephrosis from the high tension in the tumor, may feel like a solid growth. The pain, however, is so much more severe in the smaller hydronephrosis that there is little chance of error. Large hydronephrosis is most likely to be mistaken for echinococcus cyst of the liver, cystic dilatation of the gall-bladder, and ovarian cysts; the smaller ones, with their severe acute attacks, for empyema of the gall-bladder and appendicitis.

The diagnostic points between echinococcus cyst of the liver and large hydronephrosis are that the cyst is immobile and cannot be separated from the liver, is permanent, and not intermittent, and the urinary findings of the latter will serve to make a diagnosis. From cystic tumor of the gall-bladder the diagnosis may be more difficult. The history here will be important. The gall-bladder tumor is attached to the liver and cannot be felt in the loin space. The examination of the urine may be the deciding factor in clearing up the case. The following case will illustrate:

Case III.—Mrs. N., aged forty-two years. The family history and the previous personal history were of no importance, except for an irregular menstrual history of too profuse flow for two years past.

She had been operated on for supposed gall-bladder disease, but her doctor told me that the organ was found to be normal, and so nothing further was done. Her trouble dated back some years, probably seven or eight, but her acute symptoms began three years ago, with frequent attacks of severe pain, starting in the right lumbar region and radiating anteriorly to the right inguinal region and down

the inner side of the thigh to the knee. The attacks were variable in duration and frequency, lasting from one-half to two hours and recurring at intervals of from one to six weeks. At times the attacks were accompanied by chills, generally by nausea and vomiting, and were frequently followed by the passage of a large quantity of pale urine. Between seizures the patient was generally comfortable, except for a sense of "soreness" in the loin on motion or jarring. She has never noticed blood or gravel in the urine. Three weeks before admission to the hospital, after a period of three months' freedom from attacks, the patient had a series of five or six rapidly recurring attacks, very severe in character, These have been accompanied by much gastro-intestinal irritation, chills, fever, and sweats. She had been confined to bed constantly for three weeks past. The soreness in the right side had become progressively more acute and her general condition much weakened.

She is a moderately obese woman; color, pale. Heart: quality of sounds good. Lungs, clear. Abdomen, pendulous; no rigidity. Fulness on the right side, but on account of the thick abdominal walls and great tenderness, no attempt was made to demonstrate a tumor. There is tenderness in the right lumbar region and extending around the loin to the hypochondrium.

Cystoscopic examination showed normal bladder walls and a functionating left kidney; pus from the right ureter. The examination of the urine showed many granular and hyaline casts, traces of albumin, leukocytes, and a few red blood cells, amorphous urates, and epithelium. Examination of the blood showed hemoglobin, 54.0 per cent.; leukocytes, 27,050; polynuclears, 92.0 per cent.; small lymphocytes, 4 per cent.; large lymphocytes, 3.5 per cent.; transitionals, 0.5 per cent. Culture on September 9, 1908, revealed a bacillus of the colon group.

An incision was made beginning just internal to right anterior iliac spine, and continued obliquely upward and outward. A large fluctuating mass was found in the region of the kidney, approximately 9 x 6 x 4 inches and adherent to the peritoneum, diaphragm, and parietes. On incision a large quantity of thin brownish pus escaped. The wall of the mass was found to be a tremendously thickened capsule of the kidney, at the bottom of which a pus kidney was found.

The subsequent history is interesting. The sinus made by the rubber drainage tube in the kidney healed and broke down several times. On one occasion she had started for home and had got as far as Baltimore when it broke open, and she returned to me. I then re-operated, and found the kidney so nearly recovered that I decided not to remove it. The urine from the sinus was clear, the voided urine was normal, and contained practically no pus. The sinus was finally healed by removing the obstruction which existed at the junction of the pelvis and ureter by passing ureteral sounds and

washing out the pelvis of the kidney. It seems to me that this patient had had a hydronephrosis of long standing. She had been operated on for gall-bladder trouble when she had a dilated kidney pelvis. This hydronephrosis became infected later, making, finally, a pyelonephrosis. It also proved the wonderful recuperating powers of the organ and brings into question the advisability of removal of the kidney in all suppurative conditions.

From ovarian cyst one must make a pelvic examination, and if the tumor is ovarian its attachment to the uterine wall will be an important distinguishing feature. The cyst may give rise to the obstruction of the ureter, with resulting hydronephrosis. Under such circumstances, operation would be the only possible means of differentiating. The smaller cysts of the kidney may similate either empyema of the gall-bladder or appendicitis in a retrocecal appendix. In both latter conditions the constitutional reaction is greater and the pain different. The characteristic urinary findings are absent. The previous history is also of importance.

In appendicitis the pain is at first general, later becoming localized, is paroxysmal, and is followed by vomiting, while in acute hydronephrosis it is more likely to start in the loin and to be referred to the bladder or external genitals. The diagnosis of abscess of the kidney parenchyma from acute appendicitis is not so clear, especially if the appendix be high and the abscess be in the lower pole of the kidney. I have operated such a case. I opened the abdomen for the appendix, which was normal. Upon examining the kidney, I discovered a localized fluctuating mass in the lower pole. A loin incision demonstrated the correctness of the finding. This is an example of hematogenous infection and was secondary to some other focus. Many of the kidney infections are hematogenous and are secondary, and this may be the illuminating fact in the differential diagnosis.

Exploratory operations are justifiable in cases in which a reasonable doubt exists as to the exact diagnosis, and in the class of cases under discussion, in which something must be done to relieve the patient, I would advise such a course. It has been my experience that the classic symptoms of disease as described in our text-books are only averages and are not met with at the bedside one time in ten.

An exact method of estimating the degree of hydronephrosis is by the dilatation of the pelvis of the kidney by means of the ureteral catheter. We can accurately estimate how much fluid is necessary to dilate the pelvis and bring on an attack of colic. If this fluid be of the organic silver salts, an *x*-ray picture will show the exact outline of the pelvis and the position of the kidney. The course of the ureter and any obstruction therein can be photographed by means of lead ureteral sounds, so that a shadow can be seen to be in the ureter or outside, *e. g.*, phleboliths, calcareous glands, etc.

If one of the acute exanthemas or local septic processes is fol-

lowed by attacks of renal colic, pyrexia, chills, etc., one should suspect embolic infection of the kidney. If a suppurative cystitis, especially one complicated with retention of urine in the bladder, prostatic hypertrophy, stricture of the urethra or urinary obstruction from pregnancy, pelvic tumors, etc., is followed by pain and tenderness in the lumbar region, one should suspect infection of the kidney on that side. If the urine, drawn aseptically, contains bacteria in a patient who does not have cystitis, the kidney is shown to be infected. If the urine constantly shows pus, and an enlargement of the kidney can be demonstrated, the diagnosis of a suppurative process is certain, even though it is not possible to say whether the suppuration is in the kidney itself or whether there is pyonephrosis.

A classical group of symptoms which indicates a pyonephrosis is sudden temporary obstruction to the urine, with the rapid formation of a very painful tumor, and the clearing up of the urine, which previously contained pus, the patient meanwhile growing worse. If traumatism precedes such symptoms, the picture is made more clear. If a renal abscess breaks into the pelvis there will be a sudden appearance of a large quantity of pus in the previously clear urine. Here the pain and tenderness in the lumbar region, with marked constitutional symptoms, precede this event, and this in turn will be preceded by some foreign focus of infection.

Cystoscopy will clear up the diagnosis. One can see the pus exuding from the ureteral orifice of the affected side, and, if possible, a specimen should be obtained for further examination. If cystoscopy is impossible or inconvenient, the diagnosis of renal pyuria can be strengthened by irrigating the bladder. When once the water returns clear it will not become cloudy for some little time if the pus is due to cystitis; whereas, if the pus comes from the kidney, it will become cloudy very soon.

Infections of the kidney arise in one of two ways: by means of the blood, or by ascension of microörganisms from the lower urinary tract. Hematogenous infections, until comparatively recently, were considered rare, a belief which is far from being true. This is easily understood when we consider that bacteria in all forms of bacteremia must pass through the kidney, and it is evident that any favoring condition, such as obstruction to the urinary flow or any flaw in the protecting membrane, lining the calices or pelvis, or diseased condition of the parenchyma, may be sufficient to precipitate a suppurative attack in the kidney. It is, therefore, important, in all kidney infections to search for some focus of infection. The germs of measles, scarlet fever, smallpox, pneumonia, typhoid fever, tuberculosis, and tonsillitis all pass through the kidney. Bacterium coli, staphylococci and streptococci likewise pass through the kidney, and the original focus for their generation must be looked for and considered.

The second method is by ascending infection along the ureter and the order will be: ureteritis, pyelitis, pyonephrosis, and finally involvement of the entire kidney structure. The gonococcus is the most common cause, although a number of other bacteria are frequently found to be the etiological factors—Bacillus coli, staphylococcus, streptococcus, Proteus vulgaris, etc.

Renal tuberculosis may occur as an original primary focus of infection in the body of the kidney without involvement of the ureter or bladder. It is usually secondary to foci in the other parts of the body, such as the lungs, vertebræ, etc. If the point of infection be in the kidney, it may not give rise to symptoms of sufficient severity to attract attention. Such a tuberculous collection may remain free from other infection. When, however, the pelvis is involved, as it frequently is, we usually find the other organism working with the tubercle bacilli toward the destruction of the organ. In other words, we can have a single tuberculosis of the kidney, tuberculous pyonephritis, and tuberculous hydronephrosis.

Frequently the first symptoms of kidney tuberculosis is a persistent intractable vesicle tenesmus in which there is no anatomical evidence in the bladder mucous membrane or chemical evidence in the urine to account for the symptoms. It is well to remember this point, as it is always suspicious, and should lead to a thorough investigation. Later, the cystoscope will usually show around one or other of the ureteral orifices points of redness and swelling in the mucous membrane. The urine shows many changes and alterations, depending on the location and kind of infection.

The symptoms which are most marked are: polyuria, pyuria, hematuria, albuminuria, vesicle tenesmus. Occasionally the urine will become temporarily clear, form a blocking of the ureter of the affected side, and hence a flow of normal urine from the normal kidney. With the blocking there is an increase in the size of the affected kidney. The other symptoms are those which are characteristic of tuberculosis in other parts of the body—loss of weight, disturbances of digestion, loss of appetite, hectic temperature, sweats, and chills. If in addition to these symptoms we can demonstrate a tender swelling in the lumbar region, and can find tubercle bacilli in the urine, and especially if we secure the urine from the affected side by ureteral catheterization, we can be sure of the diagnosis. The absence of tubercle bacilli in the urine is not proof that tuberculosis of the kidney does not exist.

Locally, we can usually make out an enlargement of the kidney which will increase steadily, with sudden increase, if the ureter becomes blocked. This tumor may give rise to pain and tenderness, although these symptoms are common to all infections of the kidney. The pain is due to distention of the pelvis from blocking of the ureter or to inflammatory congestion.

Hematuria is always a grave symptom and its cause should be carefully searched for. It is frequently the first indication of tuberculous disease of the kidney. Professor Schede has this to say:

"In making a differential diagnosis, it is well to remember that hemorrhage, pain, and enlargement of the kidney are caused by a calculus, or a newgrowth, as well as by tuberculosis, and that the pain and enlargement may be due to kinking of the ureter, and congestion to the influence of bacteria, and that pain, enlargement, and pyuria are caused by non-tuberculous suppuration of the kidney, and that vesicle symptoms and tubercle bacilli in the urine may be due to tuberculosis of the bladder. Therefore, hemorrhage, pain, and renal enlargement are not characterisic; and even if the presence of a calculus is definitely shown by the *x*-rays, it may have developed secondarily to tuberculosis, or tuberculosis may follow the formation of a calculus. The local reaction following an injection of tuberculin is a characteristic sign which does not appear under other circumstances, and a general reaction after the injection is an almost certain proof of the presence of a tuberculous foci somewhere in the body. In the present state of our knowledge of the treatment of renal diseases such a fine differential diagnosis is generally not important. If it can be shown that there is present either suppuration or calculus in the kidney, or renal tuberculosis, or a neoplasm, the duty of the surgeon is to expose the kidney, and, if necessary, to split it open in order to determine the nature of the disease, and to apply such measures as are indicated."

REVIEWS.

A MANUAL OF OPERATIVE SURGERY. By SIR FREDERICK TREVES, Bart., G.C.V.O., C.B., LL.D., F.R.C.S., and JONATHAN HUTCHINSON, F.R.C.S., Surgeon to the London Hospital. Third edition; in two volumes. Vol. I, pp. 775; 209 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

WHEN the first edition of Treves' *Operative Surgery* appeared (1891), the reviewer in this journal was of the opinion that it was "the most comprehensive and at the same time the most clear and concise manual of operative surgery which had been written in modern times." The second edition (1903), revised by Mr. J. Hutchinson, Jr., was still thought to merit commendation as to the "excellent average judgment displayed in the difficult task of selecting from among thousands of varying procedures those most worthy of description," and as to the manner in which the information thus gathered was presented. This latest edition (1909) has—as to this present first volume—been partly rewritten by Mr. Hutchinson, and has been, in the main, thoroughly revised. The retirement of the original author from all active professional work preceded the appearance of the second edition, and it is to be assumed that the editor is now solely responsible for the changes made and for the opinions expressed. In the main, these are in the direction of improvement, and the original opinions above quoted may be reiterated. There is shown, however, a tendency to emphasize somewhat excessively the work and teachings of British surgeons, which has militated against the thoroughness of this revision. We find, for example, that there are approximately between three and four dozen references to American surgeons (living and dead), and between 350 and 400 to English surgeons. A large portion of the book is devoted to abdominal surgery. We find one reference to the Mayos (in relation to the operation for the radical cure of umbilical hernia), and nineteen references to Moynihan, and twenty-four to Mayo Robson. In that part of the book relating to genito-urinary surgery, there is a similar disproportion. Keyes, Watson, and Young are referred to five times, while Henry Morris, Fenwick, and Freyer are quoted twenty-eight times. We are very far from saying that any of these references should be omitted. The admirable work done by these representatives of British surgery is familiar

to all of us. But we are equally sure that in a comprehensive book on operative surgery of the abdomen and of the genito-urinary tract, no such disproportion as to achievement, either in particular work, in original additions to methods and instruments, or in contributions to surgical literature, exists today as would seem to be indicated by the above figures. The apparent lack of familiarity with the work done in this country extends to the use of proper names. "Mr. Bloodgood" and Mr. "Cushing" and "Dr. Richardson of Harvard" look unfamiliar to American eyes.

In 1891 a preference for British surgery may have been justified, although, in the first edition of Jacobson's *Operations of Surgery*, which appeared in 1888, the references to American surgery were notably full and numerous. In 1903 the basis for such a preference had certainly largely disappeared, not because of any falling off in British surgery, but by reason of undoubted improvement in this country. In 1909 there can be no question that we can each learn from the other to at least an equal extent.

Following out this line of thought, it would be possible to note a number of omissions of more or less importance. It seems a pity, for example, that when there was room for the humorous (?) statement, that "it is told of one surgeon that before driving to an operation his carriage wheels were always washed over with ether and carbolic solution," there was not also room for a description of the operative methods now so widely used in cases of acute diffuse peritonitis. Some very minor criticisms are also justified, as, for example, the arrangement in the table of contents, by which the heading of Part II—"Abdominal Operations" (also continued as a running page heading through part of the volume)—is made to seem to include urethrotomy, perineal prostatectomy, operations on the ruptured perineum, etc. But, on the whole, the care, the wide research, and the sound judgment of the original author, with the additions made by the editor, still maintain the position of the book as one of very distinct usefulness to the operating surgeon.

J. W. W.

CLINICAL EXAMINATION OF THE URINE AND URINARY DIAGNOSIS. By J. BERGEN ODGEN, M.D., Medical Chemist to the Metropolitan Life Insurance Company, New York. Third edition. Pp. 427; 54 illustrations. Philadelphia and London: W. B. Saunders Company, 1909.

THE former editions of Odgen's work on urine analysis appear to be so well known that the third edition of this book, which has been recently published, hardly requires extended comment. The author states that in the new edition the subject matter has been thoroughly revised so as to conform to the numerous advances which

have of late taken place in this important branch of clinical pathology. In view of such an assertion it is particularly disappointing to note a number of important omissions.

In the chapter on the chemistry of the urine it is somewhat surprising to find that all reference to ammonia and its quantitative estimation has been omitted; in spite of the fact that it is generally conceded that in conditions such as diabetes the quantity of ammonia in the urine furnishes a valuable index of the degree of acidosis present. Among the tests given for the detection of urobilin no mention is made of the dimethyl-amido-benzaldehyde method, one of the simplest and best of the newer tests. Further on, while discussing the carbohydrates, the author completely ignores levulose and maltose, although he devotes over two pages to laiose and inosite. Levulose at least, it would seem, merits mention, in view of the significance attached by some to the production of levulosuria in certain lesions of the liver. Again, a useful addition to the paragraph on the detection of acetone would have been a description of Lange's test, now regarded by many as superior to the older tests of Legal and Lieben which are given.

The selection of quantitative methods has been carried out, upon the whole, satisfactorily. Exception, however, may be taken to the method described for determining the acidity of the urine, which is regarded by most physiological chemists as inaccurate and much inferior to the method of Folin of which no mention is made. Also, among the several methods given for the quantitative estimation of urea, the more convenient method devised by Folin has been omitted.

The chapter devoted to the consideration of urinary sediments and calculi are most complete and deserve only favorable criticism. The value of the one on urinary sediments is decidedly increased by the presence of a large number of clear and useful illustrations.

The second part of the book furnishes its most original feature and should strongly appeal to clinicians. In it the author applies the information obtained by analyses of the urine to the diagnosis not only of disease of the urinary tract, but also to a number of other diseases characterized by noteworthy urinary findings. Particular emphasis is laid upon the various abnormalities of the urine met with in the separate types of nephritis and different stages of the same type. Odgen points out with truth that as yet we are unable to differentiate either clinically or in the laboratory, the several pathological varieties, into which acute diffuse nephritis is commonly divided. It is also gratifying to note that the author adheres to a simplified rational classification of nephritis, although he does complicate matters somewhat by describing a third form of chronic nephritis, termed chronic diffuse nephritis, in addition to chronic interstitial nephritis and chronic parenchymatous nephritis, which he prefers to designate "subacute glomerular nephritis." While discussing the urine of diseases other than renal, it is rather remark-

able that the writer has entirely overlooked the urinary changes attributed to chronic pancreatitis, although the less characteristic changes in the urine of such conditions as melancholia and acute myelitis are mentioned. In this connection it should be pointed out that nowhere in the book is there any description of the now well-known and frequently discussed Cammidge reaction.

By reason of the somewhat elementary manner in which many of the subjects are dealt with, in addition to the sundry omissions, it must be confessed that Odgens' book can hardly be regarded as of great value to the physiological chemist and clinical pathologist. Among students and practitioners of medicine, however, for whose use it was especially designed, the new edition of this work should continue to enjoy the same popularity as the earlier editions. Since an entirely new section has been added on the examination of urine for life insurance, the present edition may also be expected to be particularly welcome to the many interested in that line of work.

G. M. P.

DISEASES OF THE STOMACH. By S. H. HABERSHON, M.A., M.D., F.R.C.P. Pp. 565; 19 illustrations. Chicago Medical Book Company, 1910.

THIS is a compact work in which there is much to praise. The style is clear. The illustrations are excellent and are distinctly illustrative. Those in the first part of the book showing models of the abdominal viscera *in situ* are among the best published, and some in the back part of the book illustrating pathological conditions, many of them colored, are equally satisfactory. There is a preliminary section of fifty pages on anatomy and physiology and another of fifty upon the discussion of diet. It will be noted, no doubt, that there has been a slight confusion in the use of the term calorie. The author objects very much to twice cooked meats and particularly to the strong sauces in which they are served, because they may cause biliousness and bilious attacks, whatever these may be. Seven pages are devoted to physical signs and they are most inadequately described. Indeed, all through the book, physical examination is neglected to a very serious degree. One sign that he describes appears to be new, that is in cases of spurious gastric ulcer, obliteration of the carotid artery during the palpation of the stomach will cause the local tenderness to disappear. He places great faith in the coin method of auscultatory precussion. The section on the examination of the gastric contents is fairly satisfactory. The forty pages devoted to symptomatology are enough, particularly as the symptomatology of the various conditions is given quite fully. Eighty pages are devoted to dyspepsia for which a very

elaborate classification is devised. It is probably fair to say that such a classification, while evidence of the author's ingenuity, is of comparatively little value in clinical medicine. Fifty pages are devoted to gastric disorders in their relation to general disease. There is then a discussion of the various forms of gastritis, a very good description of gastric ulcer with excellent utilization of the literature, not perhaps the most modern part. The diagram on page 379 is rather difficult to understand, as it would appear that at certain ages everyone must have gastric ulcer. The section on ulcer of the duodenum is entirely inadequate and the same may be said of that on gastroptosis. The subject of carcinoma is, however, well discussed, although the physical signs and symptomatology might have been given fuller treatment.

In conclusion we wish to quote the author's opinion upon some of the modern terms suggested for gastric conditions. "The matter of classification is not elucidated by the introduction of a classical nomenclature which is adopted by many Germans and Americans. Some terms are valuable because they carry their meaning with them or are consecrated by old and familiar usages. Other terms . . . are unintelligible to the ordinary reader, though they may show the erudition of the author or his classical ingenuity."

J. S.

MODERN PROBLEMS IN PSYCHIATRY. By ERNESTO LUGARO, Professor Extraordinary of Neuropathology and Psychiatry in the University of Modena. Translated by DAVID ORR, M.D., and R. S. ROWS, M.D., LL.D. Pp. 305; 13 illustrations. Manchester, England: University Press, 1909.

LUGARO's work has been well known for many years, and all English-speaking physicians should be indebted to the translators for their painstaking and earnest work. The text is divided into eight parts. The foreword is written by the well-known English Alienist, T. S. Clouston, M.D. In this Dr. Clouston has written an excellent review and criticism of the book, and the present reviewer can do no better than quote from him: "I had not read much of the translation before I found that Lugaro was one of the master spirits of biological science, who, while knowing and using the details and facts of his subject, was not content with a narrow and technical view of it, but pressed into its elucidation all the correlated sciences of anatomy, physiology, biology, and psychology. Some other men have before attempted to do this, but, while mustering many of the facts of those sciences, failed to show their exact bearing on the subject of the mental disturbances and defects of the human brain. Lugaro seems to me to have been able to set the

whole problem of psychiatry before his mind, to have realized its extraordinary difficulties, and to have pointed out future lines of research more clearly and fully than almost any of our modern authors. He combines caution with scientific enthusiasm. He avoids immature inductions. He knows just how far his facts will take him. He is not carried away by impractical theory as so many authors of the Latin races have been. He is reliable and practical, while retaining the subtle mental qualities of his race. He does not offend the common sense of the average man nor the conservatism of the lawyer in his conclusions and advice as to how criminals and cranks should be treated by society. He gives the impression that he would be a safe guide in the witness box, at the bedside, or to the social reformer.

"We Britons needed such a clear, logical, and illuminating treatise. Even its abundant theorizing will stimulate us to think. It is wider in its scope and more philosophical in its methods of treating the subject than any book of our own. In short, it exhibits more of the scientific spirit. All our alienists and most of our physicians will do well to peruse it." T. H. W.

ESSENTIALS OF LABORATORY DIAGNOSIS. By FRANCIS ASHLEY FAUGHT, M.D., Director of the Laboratory of the Department of Clinical Medicine, Medico-Chirurgical College, Philadelphia. Second edition; pp. 336; 44 illustrations. Philadelphia: F. A. Davis Company, 1910.

THE author has made several changes in the second edition of his *Essentials of Laboratory Diagnosis;* these include short additional sections on serodiagnosis, in which the Wassermann reaction is discussed; on the special methods for the detection of tubercle bacilli (including the use of antiformin); and on the determination of pancreatic activity by a new method. The section on opsonins is materially shortened, and the technique, which appears in detail in the first edition, is omitted; while the section on blood pressure has been re-written and considerably amplified. The microscope and its accessories are fully described in the first section, but one cannot agree in all the details with the author's exposition of the subject. There are omitted in Section III, descriptions of the Tallqvist method of estimating hemoglobin and of the blood changes in Hodgkin's disease, each of which is sufficiently important to justify incorporation with the text. Section V, on blood pressure, is well written and contains many references to literature; however, its length is out of proportion to the other sections. Sections III and VII, on blood and blood parasites, respectively, might have

been combined systematically and the text enhanced thereby. Section IX makes no reference to the Oppler-Boas bacillus in gastric analysis; and under urinalysis, there is, likewise, no reference to the qualitative and quantitative estimation of oxalates and to the quantitative estimation of sulphates. The Cammidge reaction is discussed in short, but the "modus operandi" noted in the first edition has been omitted. The text contains not a few typographical errors repeated from the first edition. As the author states, the volume is intended to contain only the "essentials of laboratory diagnosis," so that much material has been intentionally omitted. A critical review shows a text which, on the whole, is commendable, notwithstanding the rather numerous points of adverse criticism which one should not unduly emphasize. The volume should be of assistance to the laboratory worker.

W. T. C.

THE CAMPAIGN AGAINST MICROBES. BY ETIENNE BURNET, M.D., of the Pasteur Institute. Head of the Vaccination service of the city of Paris. Translated from the French by E. E. AUSTEN, F.Z.S. New York: William Wood & Co., 1909.

IN the present day, when medicine is given such publicity and, aside from a certain idle curiosity, is a subject of real interest to many intelligent persons in no way associated with the medical profession, a book such as this is bound to receive well-merited attention, and will be read with absorbing interest. The title is not especially well chosen, for it smacks of an attempt at popularity not altogether pleasing. The book, however, is a revelation and of such absorbing interest that it is with difficulty that one puts it down. A half dozen problems of the utmost importance to the public health and safety are discussed in a truly scientific manner, but at the same time presented with such simplicity and clearness that they are made intelligible to the average cultivated individual. These problems are cancer, tuberculosis, tetanus, sleeping sickness, enteritis, and variola and vaccinia. The papers reflect the latest views upon these subjects and bring out in a highly interesting and accurate way the recent development of our knowledge concerning these problems. It is quite natural that though the results of investigation by the German, English, and American observers are given due credit, still the prevailing ideas come from the Pasteur Institute. This is particularly noticeable in the section on cancer, where the work of Borrel is discussed, and in the chapters devoted to the role of intestinal microbes in enteritis, where the work of Metchnikoff is discussed in full. We could not imagine a better work to put into the hands of the public and at the same time a more readable and interesting book for the profession. W. T. L.

A Text-book of Pharmacology and Therapeutics; or, The Action of Drugs in Health and Disease. By Arthur R. Cushny, M.A., M.D., F.R.S., Professor of Pharmacology in the University of London; Examiner in the Universities of London, Manchester, Oxford, and Leeds; formerly Professor of Materia Medica and Therapeutics in the University of Michigan. Fifth edition; pp. 744; 61 illustrations. Lea & Febiger: Philadelphia and New York, 1910

When first published Cushny's *Pharmacology and Therapeutics* immediately took front rank as a volume representing therapeutics as a science and tending to replace the drug empiricism of the past with scientific data based upon the ascertained actions of drugs. During the eleven years that have since elapsed the volume has become a standard text-book, and five editions have been called for; the latest represents a thorough revision. Many changes have been made throughout. The discussion of certain drugs of minor importance has been curtailed; some have been excluded altogether from consideration, in accordance with the tendency to abandon the use of drugs feeble, uncertain, or untrustworthy in their action, and to substitute therefor others of proved efficacy and trustworthiness. The most important changes comprise modifications and amplifications of the discussion of a number of important drugs, such as digitalis, ergot, adrenalin, etc., in accordance with the results of recent experimental and clinical observations; the incorporation of new points of view in regard to certain more or less specific remedies, such as arsenic and mercury, that have followed the investigation of trypanosomiasis and other protozoal infections; and the inclusion of the essentials of antitoxic remedies. But there are many other important changes and additions that bring the book fully abreast of the times. Professor Cushny points out the growing interest in the actions of drugs and their application and the abandonment of the nihilistic attitude toward therapeutics; and his book very well reflects these points of view. A. K.

The Vegetable Proteins. By Thomas B. Osborne, Ph.D., Pp. 125. London: Longmans, Green & Co., 1909.

Under the joint editorship of Dr. R. H. Aders Plimmer and Dr. F. G. Hopkins ten monographs on biochemistry have been published, each monograph being written by an author who is himself working at the subject with which he deals. As the editors state in the general preface, it is impossible for text-books to deal adequately with the subject of physiological chemistry without being cumbersome, and, furthermore, the subject has been growing

so rapidly that new editions of text-books are issued when much of their contents has become obsolete. "For this reason an attempt is being made to place this branch of science in a more accessible position by issuing a series of monographs upon the various chapters of the subject, each independent of and yet dependent upon the others, so that from time to time, as new material and the demand therefore necessitate, a new edition of each monograph can be issued without re-issuing the whole series. In this way both the expenses of publication and the expense to the purchaser will be diminished, and by a moderate outlay it will be possible to attain a full account of any particular subject as nearly current as possible."

Dr. Osborne, who has done so much research in the chemistry of the vegetable proteins, has written a noteworthy monograph on this subject, summarizing with a rare combination of brevity and clarity the work to date of himself, co-workers, and others. The monograph lends itself poorly to a review, but it is to be recommended to all those whom the subject interests, for the book will be found to be a complete compilation with full bibliography of the work published on the vegetable proteins. E. H. G.

THE PRINCIPLES OF HYGIENE. A PRACTICAL MANUAL FOR STUDENTS, PHYSICIANS, AND HEALTH OFFICERS. BY D. H. BERGEY, A.M., M.D., Assistant Professor of Bacteriology in the University of Pennsylvania. Third edition; pp. 555; 62 illustrations. Philadelphia: W. B. Saunders Co., 1909.

THE third edition of this well-known book presents much the same form as its predecessors. The changes and additions are not numerous except in regard to immunity, which has been largely rewritten. The principles of the newer methods of treatment by the production of immunity have been added, and the use of inactivated bacteria as well as the newer sera, such as that of Flexner for cerebrospinal meningitis, are briefly discussed. The subject of hygiene is a large one and necessarily touches many and various subjects, so that the difficulty of selecting properly and condensing the material into a comparatively small volume is not always simple. This part of the task the author seems to have admirably accomplished, and the book will continue to be of value as a presentation in a brief and modern manner of the subject of the principles of hygiene. G. C. R.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Hemophilia.—On the basis of four cases, SAHLI, in a previous communication (*Ztschr. f. klin. Med.*, 1905, lvi), emphasized that: (1) The leukocytes are normal or slightly decreased in number, with relative increase of lymphocytes; the number of blood plates is normal. (2) The alkalinity and freezing point of hemophilic blood is unchanged. (3) The fibrin content is not decreased. (4) The single characteristic feature of hemophilia is the prolonged coagulation time. After considerable loss of blood the coagulation time decreases, and may reach normal limits. These observations he confirms upon two new and one of the previously studied cases; he then considers the nature of the disease. The coagulation of hemophilic blood is increased by the addition of defibrinated blood which has been rendered fibrin-ferment-free, by heating to 60° to 62° for half an hour. This points to thrombokinase—not thrombogen—as the substance which is decreased in hemophilic blood. Normal blood serum, after removal of fibrin ferment by heat, also accelerates the coagulation of hemophilic blood, though less strongly, indicating that thrombokinase is normally to a certain extent excreted by the corpuscles into the serum during coagulation. Normal corpuscles washed ferment-free, strongly increased the coagulability when added to hemophilic blood, while similarly prepared hemophilic corpuscles produced a like but very slight effect. Hemophilia is, therefore, a disease due to a decreased content, or decreased availability of the thrombokinase, in the blood corpuscles. Whether this is an anomaly of the erythrocytes, leukocytes, platelets, or of all three, is uncertain. Repeated injections of fresh human serum; and repeated small bleedings to stimulate the physiological reactive thrombokinase-formation are recommended.

Ochronosis.—POULSEN reviews 16 previously published cases and contributes 9 new ones (*Beitr. z. path. Anat. u. z. allg. Path.*, 1910, xlviii, 346). Of the 25, 13 were in men, 12 in women. The average age was fifty-four. Fourteen have come to autopsy with uniformly characteristic lesions. Of the 11 unautopsied cases (10 of which are still alive), the characteristic pigmentation of the cartilages of the nose and ear, the brown scleral spots, and the presence either of alkaptonuria or the history of long continued application of carbolic acid to chronic ulcerations, leave no doubt as to the diagnosis. The pigment has characteristics of an acid in that it dissolves in alkalies. At the same time, it is to a certain degree amphoteric. It contains 2.44 per cent. S, but no Fe, and it gives no absorption spectrum. It stands nearest, as Hecker, Wolf, and Pick have agreed, to melanin. Clinically, pigmentation has been noted in the ears of 18, in the scleræ of 14, in the nose of 7, in the skin of 10, the finger nails of 1, and the tarsal cartilage of 1 of these 25 cases. Pathologically, the costal cartilages, intervertebral disks, articular surfaces of the large bones, and the tracheal rings are constantly found pigmented. The epiglottis and laryngeal cartilages are usually less deeply colored. The ligaments are affected in about one-half, the tendons, particularly near their insertions, in nearly two-thirds of the cases. Discoloration of the bones has been noted in less than one-half the cases, and was never extreme. Of the internal organs, the intima of the heart or aorta was pigmented in 11 of 12 cases; the kidneys, though frequently only after microscopic examination, showed pigment in 7 of 11 cases, the liver in 2, and the intestine and dura in 1 case each. In cartilage, the deposition is in the matrix, the capsule and cells being spared or little affected. An exception to this is in injured cells which are strongly pigmented. In cases with arthritis deformans, the cartilage is now deeper (Pick), now little (Hecker and Wolf, Poulsen I.) colored. The chief deposition of pigment is near the more vascular areas. In the kidney, Poulsen found pigment in the epithelium of the convoluted tubules.

Deviation-of-the-Complement in Typhoid Fever.—CATHAIRE (*Comp. rend. Soc. de. biologie*, 1910, lxix, 117) employed in the diagnosis of typhoid fever the so-called rapid Wassermann method of fixation-of-the-complement used for the diagnosis of syphilis. The natural hemolysin was used which human serum contains for sheep corpuscles, and the complement of normal blood. The antigen was an alcoholic extract of a spleen removed at autopsy from a typhoid patient who died on the fifteenth day of the disease. The serum of the patients was taken on about the tenth day. One-tenth c.c. of serum was used with 0.1 to 0.2 dilutions of antigen. After an hour in the thermostat, 0.1 c.c. of sheep corpuscles washed and diluted to 0.05 was added. Of 15 patients examined, a deviation-of-the-complement was obtained with antigen dilution of 2 in 10, in 7 instances; in 8, with 1 in 10. All foreign sera tested showed no deviation in the same dosage.

The Experimental Production of Actinomycosis in Guinea-pigs Inoculated with the Contents of Carious Teeth.—ISRAEL, in 1878, noted the presence of carious teeth in three of five cases of actinomycosis. In one of the three he demonstrated the parasite of the disease not only in

the pus of a subperiosteal abscess of the lower jaw, but also in the root canal of an extracted, neighboring, carious molar tooth. He inferred that the parasite was harbored in carious teeth. Wright prophesied, in 1904, that actinomyces might be found as a normal inhabitant of the buccal cavity and alimentary canal. The uncertainty of the origin of the disease attracted the attention of LORD (*Boston Med. and Surg. Jour.*, 1910, clxiii, 82), who had already noted the frequency of the organisms in sputum, their failure to grow at other than body temperature, and the lack of convincing evidence that the disease was contagious. These facts suggested that the infection arose within the individual. The prevailing location of the diseases about the jaw or neck pointed to the mouth as the sources of infection. In addition, the history of much trouble with the teeth preceding the infection was conspicuous in two of the author's cases of actinomycosis. Following this line of thought, Lord made careful microscopic, cultural, and biological examinations of the contents of carious teeth removed in 16 examined cases. In all 11 cases by cover slip preparations, Gram staining filaments mixed with other bacteria were found. Serial sections studied in 5 cases were positive. The organisms were present in such numbers as to suggest that they play a fundamental part in dental caries. The cultural experiments were not yet completed. Following the intraperitoneal inoculation of guinea-pigs, omental tumors histologically identical with actinomycotic tissue and containing typical club-bearing actinomyces granules have been produced in 3 of 5 animals. In summary, Israel states that the constancy with which actinomyces are present in carious teeth suggests that, under proper conditions of seed and soil, people with carious teeth are liable to develop actinomycosis. The organisms may invade neighboring tissues or find lodgement in more remote regions by way of the respiratory tract or alimentary canal. Local injury is an important predisposing factor.

Peristalsis of the Colon.—STIERLIN (*Ztschr. f. klin. Med.*, 1910, lxx, 376) finds that after the ingestion of bismuth the first shadow can be detected in the cecum in two to three hours, in the transverse colon in four hours, in the sigmoid flexure in six hours. Six to eight hours after the meal, the small intestine no longer casts a shadow on the Röntgen screen. This bismuth remains at the cecum and the colon ascendens longer than at any other point. Here the segmentation, so well seen in the transverse and descending colon, is not clear and the peristalsis can rarely, as Holzknecht has emphasized (*Münch. med. Woch.*, 1909) definitely be seen. This agrees with the occurrence of antiperistalsis in this portion of the intestine, which has been demonstrated in animals by Cannon, tending to retain the intestinal contents at this point. At the splenic flexure the acuteness of the bend mechanically retards the intestinal content. As soon as the splenic flexure is passed, the descent to the sigmoid is unimpeded and rapid. The time taken by food to traverse the intestine varies between rather wide limits in normal individuals.

Echinococcus Serum Reaction in Tape Worm Hosts.—Since GHEDINI (*Gaz. d. Osp.*, 1907, No. 153) first introduced the complement absorption test for echinococcus, numerous authors have confirmed its value and

have shown that not only a positive but also a negative test could be relied upon with considerable certainty. Not every cyst fluid is satisfactory for antigen, however, that from the sheep being better than that from man. CHAUFFARD and VINCENT (*Gaz. d. hôp. de Paris*, 1910, lxxxiii 343) report a case in which complement fixation appeared only after the rupture of a cyst into a bronchus. Weinberg has later reported 3 cases in which a positive reaction only appeared after puncture or operation. [It is not impossible that, by using as antigen an alcoholic extract of cyst membrane, as advised by PARVU (*Bull. et Mém. Soc. méd. d. hôp de Paris.*, 3me s., 1910, xxvii, 371 and 429), some of these negative results might be avoided. A more serious objection is that of K. MEYER (*Berl. klin. Woch.*, 1910, xlvii, 1316), who, after finding that he could obtain complement fixation in the blood of 30 per cent. of hosts of Tænia saginata by using extracts of the worm as antigen, found also that echinococcus cases gave less strong but definite reactions to Tænia saginata antigen; and that, vice versa, patients with Tænia saginata gave positive reactions with echinococcus antigen.—W. S. T.]

Apparent Proof that Cammidge's Reaction is not Specific.—WHIPPLE and KING (*Johns Hopkins Hosp. Bull.*, 1910, xxi, 196) produced acute pancreatitis in dogs by the injection of 4 or 5 c.c. of pig's bile into the large pancreatic duct. All the animals with acute hemorrhagic pancreatitis gave a positive Cammidge test "C" in the urine with one exception; the crystals obtained corresponded in morphology and solubility to those described by Cammidge. Animals poisoned with chloroform showing an extensive necrosis of the liver, as a rule, gave a positive Cammidge reaction. The necrosis of the liver cells was held responsible. Two animals with bronchopneumonia gave a positive reaction. A piece of dog's pneumonic lung was hydrolized with 5 per cent. sulphuric acid for two hours, neutralized with barium hydroxide, and the clear filtrate injected into the peritoneum of a dog whose urine was previously negative. A beautiful Cammidge test developed and persisted one week. Operation then showed a normal peritoneum, pancreatic, liver, spleen, and kidney tissue. Human pneumonic lung, treated in the same way, in itself showed the reaction as well as producing it when injected intraperitoneally in a dog. Some perfectly normal female dogs, one after parturition, and some recovering from operations not involving the pancreas, gave the reaction. Whipple and King conclude that the Cammidge reaction is not specific for acute or chronic changes of the pancreas. The disintegration of any cells in the body may give the reaction, or even artificial hydrolysis of any animal tissue may give substances which will appear in the urine and give the characteristic crystals. It is possible that the disintegration of the polymorphonuclear leukocytes is an important factor in the production of this unknown substance.

The Gas Content and Viscosity of the Blood.—DETERMANN and WEIL (*Ztschr. f. klin. Med.*, 1910, lxx, 468) contrast the viscosity of blood taken before and after the production of venous stasis with the CO_2 and O_2 content. That CO_2 accumulation raises the viscosity was shown by A. V. Koranyi and Bence. This is in part due to swelling of the corpuscles in venous blood (Limbeck), but not entirely, for Adam

found a rise of viscosity in laked blood when treated with CO_2. The Determann viscosimeter was employed. The CO_2 and O_2 determinations were made by the Bancroft-Haldane method. The blood to be examined was taken from a vein without any stasis having been produced, and again, after periods of stasis lasting up to ten minutes. The vicosity was found to depend first upon the number of corpuscles. Variations from this parallelism were caused chiefly by variations in the gas content. Other factors played so small a part that, knowing the number of corpuscles, the viscosity estimation is a simple means of getting a rough idea of the gas content of blood.

The Cutaneous Tricophytin Reaction.—AMBERG (*Jour. Exper. Med.*, 1910, xii, 435) vaccinated 131 cases with tricophytin after the method of v. Pirquet. Of 13 cases with a history of tricophytosis, 9 gave a positive reaction and 4 were negative. Four cases without a history of infection were positive. Parallel vaccinations were made with tuberculin and bouillon treated exactly like the tuberculin but without any bacteria. The bouillon reactions gave uniformly negative results. The tuberculin vaccinations did not give any results not noted before. Amberg concludes that there is a far-reaching analogy between the cutaneous tricophytin reaction and the cutaneous tuberculin reaction. Both indicate that the organism is the seat of a definite infection or that it has passed through such an infection. Both may persist for a long time after the active disease has come to rest, indicating that the infection has left the organism in a state of altered reactivity—allergy. Since the reaction persists for a long time after the infection has passed, the negative reaction may be of greater value than the positive, excluding the existence of a specific infection.

Demonstration of Tubercle Bacilli.—Simultaneously from Kopenhagen and Berlin appear the communications of JORGENSEN (*Ztschr. f. Hyg. u. Infektionskr.*, 1910, lxvi, 315) and HERZFELD (*Ztschr. f. Hyg. u. Infecktionkr.*, 1910, lxvi, 336) contrasting the digestion-sedimentation methods for finding tubercle bacilli in sputum. Both agree that the so-called Doppel method of Ellermann-Erlandsen surpasses all the other methods tried—including the antiformin, the ligroin, the autodigestion and their better known modifications. The Ellermann-Erlandsen technique is as follows: (1) The sputum, in a glass cylinder, is well shaken with one-half its volume of 0.6 per cent. Na_2Co_3 solution, and then put in the incubator for twenty-four hours. (2) Pour off supernatant fluid, centrifuge the sediment, and pour off the remaining fluid. (3) To the fluid sediment add 2 to 4 volumes of 0.25 per cent. NaOH and heat to boiling while stirring. (4) Centrifuge and make smears from this sediment. Two to fifteen times as many bacilli were found by this means as by the antiformin method.

The Etiology of Pellagra.—RAUBITSCHEK (*Wien. klin. Woch.*, 1910, xxii, 963) examined spoiled corn from districts where pellagra is common, without result. Extracts from the meal or from bread made with it were non-toxic. Neither fungi nor bacteria, pathogenic in themselves, and capable of producing toxic substances in corn, could be isolated. The serum of pellagrins showed neither complement fixation nor pre-

cipitin reaction with corn meal extracts. Patients who had been kept for a considerable time upon a corn diet showed no reaction to subcutaneous injection of corn extracts. Guinea-pigs previously injected with pellagra serum were not found to be in any way sensitized toward corn. The stools of pellagra cases showed nothing typical to bacteriological examination. Cultures, taken at autopsy, were negative. (Of amœbæ there is no mention.) Fagopyrismus (see Smith, *Johns Hopkins Hosp. Bull.*, 1909, xx, 153) is a condition produced in buckwheat-fed animals by exposure to sunlight. Loss of hair, emaciation, and paralytic symptoms develop in white or partly white animals; the dark-coated escape. Sunlight alone or the buckwheat diet alone does not produce the disease. The toxic substance in the buckwheat is alcohol soluble—a lipoid. Struck by the similarity of this intoxication to certain features of pellagra, Raubitschek placed white and colored animals side by side in a series of cages exposed to sunlight. Control cages were kept in the shade. The animals were fed upon good corn, spoiled corn, rice, and mixed diet. The group fed upon mixed diet were unaffected. Of those upon corn and rice diets, the white mice exposed to sunlight showed emaciation, ataxic movements, paralytic symptoms, and death in one to three weeks. The dark animals (half breeds) alone remained alive. Animals already beginning to show symptoms recovered if placed in the dark without changing the diet. Raubitschek believes that pellagra is due not to a toxic substance in corn itself, but to the production, by the action of sunlight on the skin of those living largely on corn, of a substance which, in addition to producing local symptoms in the skin itself, has a general toxic action upon the whole organism.

Leprosy Inoculation in Animals.—KEDROWSKI (*Ztschr. f. Hyg. u. Infektionskr.*, 1910, lxvi, 1) reports the inoculation of rabbits and white mice with Bacillus lepræ. He found that in culture this bacillus assumed irregular forms; so that it probably belongs, with the tubercle and diphtheria bacilli, in the streptothrix or actinomyces group. Both in culture and in the body of man or laboratory animals it frequently loses its acid-fast quality. This is not, as Unna believes, an indication of death in the bacilli. In artificial cultures, diphtheria-like shapes are common; branched forms occur, but are rare. Cultures seldom retain their acid-fast quality, but usually regain it on inoculation into animals. In rabbits, inoculation into the lymphatics produces a picture which can hardly be differentiated from experimental tuberculosis. Intravenous injection leads to the formation of nodes made up of cells whose protoplasm is filled with bacilli. Such nodes are scattered throughout the internal organs. In white mice, nodules of large, granular, sometimes vacuolized cells filled with countless bacilli closely pressed together are produced. Kedrowski completely agrees with and emphasizes Danielsson's view of the extremely close relationship between leprosy and tuberculosis. The best inoculation results are to be obtained with mice and rats, animals in which leprosy, or a very similar disease, occurs spontaneously.

SURGERY.

UNDER THE CHARGE OF

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Intestinal Occlusion and Intestinal Paralysis Including Peritonitis.—THIEMANN (*Archiv f. klin. Chir.*, 1910, xcii, 567) says that ileus from inspissated fecal masses occurs in chronic constipation with general atrophy and weakness of the musculature (for example, in spinal cord paralysis), and in anomalies of length and width of individual portions of the intestine. A rare occurrence is the formation of multiple fecal calculi in the large intestine, with resulting diverticula formation and perforation. A comparison of the statistics of gallstone ileus of earlier and later years shows a considerable diminution in the mortality. Foreign bodies entering by the mouth rarely cause complete obstruction, since those which pass the œsophagus usually pass through the intestine. Their chief danger comes from perforation, which occurs most frequently in the ascending portion of the duodenum. Characteristic of chronic inflammation resulting from perforated foreign bodies, is a peculiar, hard swelling of the surrounding tissues, which can secondarily obstruct the intestine. Benign intestinal tumors as such rarely cause ileus, but more frequently invagination. The mortality after operation for stenosis of the large intestine is high and is especially the result of the development of acute ileus. Carcinoma of the ampulla of the rectum rarely causes complete obstruction, but is usually inoperable. Any inflammation in the abdomen can cause ileus from adhesions, which can lead to disturbances a long time after healing. Peritoneal tuberculosis with effusion is favorably influenced by opening the abdomen. Circumscribed abscesses, forming tumors, as well as stenosing tuberculosis, are improved. Complete stenosis and ileus are very rare. More frequent is the occlusion from adhesions and bands due to a primary tuberculosis of the mesenteric nodes, especially when in the stage of caseation and suppuration. In chronic mesenteric peritonitis, the separation of all adhesions is fruitless and often dangerous, since recurrence is likely to follow in an aggravated form. In the cases of appendicitis in a hernial sac with symptoms of strangulation, the former was always the primary disease. Especially severe are the symptoms of torsion of epiploic appendages in comparison to the size of the object. Volvulus is most frequent in the large intestine, especially at the sigmoid flexure. It is favored by abnormal length of the flexure as well as by chronic inflammation of its mesentery, which approximates its limbs toward each other, thus interfering with the fecal current in the end of the loop. To avoid recurrence, an anastomosis between the

limbs at the ends is advised. In general, in perforated gastric ulcer, it will suffice to close the opening by suture and to cover it over by omentum. Especially to be avoided is the excision of an ulcer of the lesser curvature, since this tends to an excessive loss of substance, and to the necessity of an extensive transverse resection of the wall of the stomach. When the ulcer is situated at the pylorus a gastro-enterostomy often cannot be avoided. After the removal of escaped material the peritoneal cavity should be closed. A perforation which has lasted more than twenty-four hours may get well by this treatment. Perforation of a gangrenous gall-bladder is very unfavorable. Of all means for the prevention of postoperative adhesions, the most effective is the early stimulation of peristalsis by the employment of enteroclysis with saline solution.

Cystoscopic Examination in Renal Tuberculosis.—BARRINGER (*Annals of Surgery*, 1910, lii, 238) says that by means of the cystoscopic examination we can almost always tell which kidney is affected in renal tuberculosis. The exception to this is when the tuberculous process is shut off from the kidney pelvis or when the kidney excretes nothing at all through the ureter. The extent of the lesion cannot be accurately determined by the cystoscopic examination, which must in all cases be supplemented by ureteral catheterization or urinary separation. Aside from its rigidity, the most typical changes in the ureteral orifices are, (*a*) tubercles around the orifice; (*b*) red granulations; (*c*) an enlarged, thickened, and ulcerated orifice. A ureter which looks normal and which is contracting and excreting urine, indicates in the large majority of cases a kidney which is excreting normal urine as regards pus and tubercle bacilli, and has a normal functional capacity. In some cases the diagnosis of tuberculosis can be made by means of the cystoscopy alone. This is of considerable value when tubercle bacilli are not found in the urine.

Duodenal Ulcer and its Surgical Treatment.—ZESAS (*Deut. Ztschr. f. Chir.*, 1910, cv, 494) reports three cases of duodenal ulcer operated on by Wilms, who explored the ulcer with the finger inside the duodenum before treating the ulcer itself by folding it in with sutures. The stomach was brought into the abdominal wound, a purse-string suture was placed in the anterior wall of the stomach, an opening made within the suture, the finger introduced through the opening, and the purse string drawn tightly around the finger. The latter was then passed through the pylorus into the duodenum, where in each case it palpated the ulcer close to the pylorus. After the withdrawal of the finger the opening in the stomach wall was closed by the purse-string suture. The ulcer was then folded inward and the wall of the duodenum on both sides of it approximated by suture. In the second case a gastro-enterostomy was performed. All three patients recovered. The method is simple and permits direct treatment of the ulcer, but does not apply to those ulcers so low in the duodenum that they can not be reached by the palpating finger introduced into the stomach. These, however, represent the least frequent of the duodenal ulcers. In small, frequently repeated hemorrhages, radical operation, either by the folding in of the ulcer according to the Wilm's method or its excision, is indicated. The

treatment of greater hemorrhages shows a divergence of opinion. Savariaud recommends in such cases a ligation of the pancreatico-duodenal artery. Gastro-enterostomy has been employed successfully in these as in the cases with smaller hemorrhages. In one of Jaboulay's cases, however, the hemorrhage persisted after the gastro-enterostomy, and the patient died. Moynihan regards it as the ideal method in duodenal hemorrhages. Other observations tend to show its insecurity in the treatment of the hemorrhage or the ulcer itself. Perforation of the ulcer is more frequent than hemorrhage. The mortality is high and the higher the longer the operation is delayed after the occurrence of the perforation. Retroperitoneal abscesses must be opened, posteriorly through the lumbar muscles or from the side, and drained. The prognosis is not so bad as in subphrenic abscesses, which, according to Lieblein, prove fatal whether operated on or not. When there is a duodenal stenosis gastro-enterostomy is the normal operation to be performed. The rule should be that all affections of the stomach threatening the life of the patient, by deficient nourishment, continuous disturbances, hemorrhages, or perforation, call for operation.

Wounds of the Heart.—Iselin (*Deut. Ztschr. f. Chir.*, 1910, cv, 572) reports a case of successful operation for gunshot wound of the heart, in a girl, aged twenty years, who was found unconscious after an attempt at suicide, one hour after which she was brought to the clinic. On the left side of the chest, just internal to the mammary line, in the fourth interspace, was found the wound of entrance. The heart distress was not marked, the pulse was regular, strong, and the rate was about 120. The diagnosis was made of a wound of the chest with a suspicion of a wound of the heart and lungs. Iselin saw her first one and three-quarters hours after the wound had been inflicted. The breathing was then labored and the pulse could not be felt. Operation was performed at once. The wound of entrance which passed through the mammary gland was excised, and an incision was made along the fourth intercostal space. The fifth rib was divided in its bony portion as well as its cartilage near the sternum. On retracting the sides of the wound, the pericardium and pleura were exposed. A strong stream of blood escaped from the upper par of the pericardial sac, which was tensely filled. After opening it widely there was seen in the wall of the anterior ventricle, nearer its base than its apex, a small irregular hole, out of which spurted blood. The heart was brought forward and held by the hand. The wound of entrance and the somewhat larger wound of exit in the posterior wall at the same level were easily closed with catgut sutures, which did not penetrate the whole muscle. Blood continued to flow from both wounds. The radial pulse, which upon the opening of the pericardium and the escape of much fluid blood became again palpable, again disappeared during the introduction of the sutures into the heart. The external wound was closed by pinching and the heart allowed to recover while the gloves were being exchanged. In a few minutes the pulse could be felt. The heart sutures were now holding. The pleura contained fluid and clotted blood, but the hemorrhage did not threaten the patient's life. By lengthening the incision to the anterior axillary line, the collapsed lung was exposed and the wound in it sutured without bringing it forward. The missile was not

found. After wiping out the chest cavity the opening in the pericardium was closed to a small opening below, which communicated with the pleura and drained in that direction. The external opening in the pleura with the muscle layer was closed as tightly as possible with sutures. A large rubber drainage tube surrounded by iodoform gauze was introduced into the superficial wound and directed posteriorly. The operation lasted about three-quarters of an hour. During the first days after the operation the exhaustion was marked, while later the lung disturbances were most pronounced. Except for her demands for water, she slept almost all of the time. The wound healed without trouble and in fourteen days had cicatrized. It is now well concealed under the overhanging breast.

Autoplastic Transplantation of Bone. JANEWAY (*Annals of Surgery*, 1910, lii, 217) says that the available methods of filling in deficiencies in bone have never been popular. A woman, now aged forty-two years, twelve years ago had removed from the left arm a tumor about 5 inches long which was found attached to the anterior surface of the ulna by a flattened pedicle. The point of attachment in the ulna was curretted. Recurrence was noticed in one year, the growth now being about 2 inches long. This was extirpated, and one year and three months later another recurrence was excised under local anesthesia. Again within four months a fourth recurrence was noticed, but the patient neglected treatment until one year and three months after the preceding operation. Through an incision along the posterior border of the ulna and dividing the joined aponeurosis of the extensor and flexor carpi ulnaris, the tumor was removed by resecting a portion of the ulna, five and one-half inches long. A fragment of the same length, three-eighths of an inch wide and one-eighth of an inch thick was now chiselled off from the crest of the tibia, together with its adherent periosteum. This was placed between the two extremities of the ulna remaining, and fastened in place with silver wire. The periosteum of the implanted fragment was also sutured to the periosteum of the remaining portions of the ulna. The wound was now closed with the exception of a small drain at each end. After the first twenty-four hours the drains were removed and a plaster splint applied. Thereafter the wound was dressed on the fourth, seventh, and tenth days, at the end of which time it was healed throughout. At no time was there any elevation of temperature. In two months the patient could freely use her arm for washing clothes at a tub. Microscopic examination showed that the growth was a chondrosarcoma. Radiograms, taken four and fourteen months after the operation, demonstrate the increase in thickness of the implanted fragment and the formation of callus at the upper end by the implanted periosteum, and at the lower end the direct union of the implanted piece with the ulna. If we inquire into the nature of the histological processes which have taken place, we must assume, as the result of the conclusions of research work upon implanted bone and periosteum, that the implanted bone itself had died, but that the periosteum and marrow lived and replaced the old bone with the new. The case illustrates the peculiar adaptability of the tibia (its accessibility and its strength and thickness) to the function of furnishing a suitable bony graft. The radiograms demonstrate

that such an autoplastic graft firmly unites to the fragments between which it is placed and eventually becomes transformed into a thicker piece of living bone, its thickness being determined by the demands for strength required in its new position. Finally, in the case cited, the smooth and rapid healing is an indication that the autoplastic method of remedying bony defects is the procedure of choice and is deserving of wider application than it at present is receiving.

Extirpation of the Thymus Gland and its Results.—KLOSE (*Archiv f. klin. Chir.*, 1910, xcii, 1125) reports that his chief, Rehn, has, up to to the present time, operated on 21 children for thymus stenosis, of which, 16 were completely cured and 2 improved. Three died because the operation was too long delayed. We know nothing of the physiological importance of this organ. For the past three years Klose has been carrying out numerous experiments on young dogs. The success of the experiments was dependent upon the surgical technique that would preserve life and remove minutely the whole organ. He concluded that the thymus is a vital organ, which in early childhood should never be entirely removed. The symptoms which follow its removal are the results of an acid intoxication, probably an acid nuclei intoxication and diminution of phosphates. In the foreground stand the bone and brain disturbances. They occur during and after the involution phase. Partial removal at the height of its anatomical existence and total removal in the involution stage show no permanent disturbances. If, however, the spleen is removed secondarily, the dog will die. The substituting organ of the thymus is the spleen. The loss of the thymus cannot be compensated for by the administration of thymus preparations. The therapeutic indication is to increase the alkalies administered. Thymus preparations do damage by increasing the acids of the body. The rational surgical therapy consists is autoplasty.

The Treatment of Exstrophy of the Bladder by the Conversion of the Isolated Cecum into the Bladder and the Appendix into the Urethra.—MAKKAS (*Zntrlbl. f. Chir.*, 1910, xxxvii, 1073) says that Maydl's operation of transplanting the ureters into the colon has become the choice for the treatment of exstrophy of the bladder. Still its mortality is high, fistula formation not rare, and continence of urine sometimes wanting. The greatest danger is that of ascending infection to the kidney, which may intervene a long time after the operation. Various modifications have been offered to overcome this danger. Makkas had conceived of using the isolated cecum as the bladder and the appendix as the urethra, but while he was waiting for an opportunity to attempt the operation, Verhoogen did it on a patient suffering from carcinoma of the bladder, which was extirpated, but the patient died. Makkas did the operation May 10, 1910, on a girl, aged twelve years, with exstrophy of the bladder, atresia of the vagina, an anus situated more anteriorly than usual, and a weak sphincter. A 12 cm. incision was made through the right rectus, the cecum isolated completely and both divided ends were closed, and the cecum displaced easily to the median line. The ileum was also divided and both ends closed. The closed ileum was then anastomosed to the transverse colon side to side. The appendix, about 7 cm. long, was passed through a small opening in the abdominal wall just below the operative incision, the distal end

removed and its mucosa sutured to the skin. The large incision was then closed by three layers of sutures. From the tenth day on the cecum was irrigated through the appendix by means of a Nélaton catheter, the irrigating fluid always bringing out some mucus. On June 18, 1910, the second operation was performed. An incision was made around the ectopic bladder, which was then separated from its bed. The ureters were isolated for about 4 or 5 cm., including as much as possible of the periureteral tissue to preserve its nourishment. A median incision was then made in the abdominal wall. The cecum now lay near the median line adherent to the anterior abdominal wall. It was opened near its lower pole and a piece of the bladder wall about the size of a five mark piece and carrying the ureteral openings was implanted into the opening in the cecum and fixed there by sutures in two layers. The abdominal wound was closed and a tampon placed in the lower angle. A Nélaton catheter was retained in the new bladder and urethra. There were no wound complications. The urine flowed freely through the catheter and the new bladder was irrigated several times daily. On the eighth day the permanent catheter was closed by a stopper and the bladder emptied every two or three hours. The capacity was at first 100 c.c., but increased considerably in the next few days. Four weeks after operation the patient was out of bed and free of fever, but still carrying the catheter. It was necessary to empty the bladder every three or four hours during the day and not at all at night. Its capacity was now 325 c.c. When the bladder is full the urine cannot escape without the introduction of the catheter. The daily quantity of urine excreted is 1000 to 1200 c.c., and it is mixed with mucus but free of albumin.

Peritonitis following Perforative Appendicitis.—Kron (*Archiv f. klin. Chir.*, 1910, xcii, 1105) says that although twenty-five years have passed since the first operation for peritonitis, opinions still vary concerning the best treatment. Unity in the terminology of peritonitis is very desirable, since many authors designate different processes in the abdominal cavity by the same name (for example, diffuse peritonitis and general peritonitis), and thus render statistics on the subject less valuable. From infection of the peritoneal cavity after a perforation of an inflamed appendix, we usually find a diffuse pelvic peritonitis, a diffuse unilateral peritonitis, a unilocular or a multilocular peritonitis. The early symptoms are such as to cause delay in reaching a conclusion. Until the present the so-called "muscular defence" is the only generally recognized early symptom. The appearance of the tongue, in connection with the general condition of the patient, will give an important suggestion for the early recognition of the disease. So far as the operative treatment is concerned, experiments on animals and the statistics of many authors with which those of Kron closely agree, speak for the dry method of treatment rather than for irrigation. The dry treatment consists essentially of complete removal of the fluid exudate, removal of the focus of infection, and the prevention of the reaccumulation of the exudate. By the former, much time is saved and the resistance of the organism spared. The success depends upon careful and skilful after-treatment. In the evening a subcutaneous injection of 600 c.c. of saline solution is given, and during the first few days 5 to 10 liters are given. Fowler's position is strongly recommended.

THERAPEUTICS.

UNDER THE CHARGE OF
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The Results of Serum Therapy in Diphtheria Compared with Results before the Use of Antitoxin.—TIMMER (*Berl. klin. Woch.*, 1910, xlvii, 1313) gives some interesting statistics regarding the effects of diphtheria antitoxin in the treatment of diphtheria. He divides the cases studied into two classes. The first class of cases comprise those treated before the use of antitoxin, and the second class includes those treated with antitoxin. In 1087 cases of diphtheria belonging to the first class, the mortality was 37.8 per cent., while in 4226 cases belonging to the second class the mortality was only 9.7 per cent. He then points out that a much smaller number of those patients treated with antitoxin require such operations as tracheotomy or intubation to relieve symptoms of laryngeal stenosis. Thus, of 1087 patients admitted before the use of antitoxin, 605 required such operations, which expressed in percentage equals 55.5. In comparing this with the antitoxin period he found that of 4226 cases, only 1231 required operations, a percentage of 29. Furthermore, the mortality in the cases operated upon is much lower with the serum treatment than before the days of antitoxin. Thus, for instance, in the 605 cases operated upon before antitoxin, 334 died, a percentage of 55.2, while of 1231 cases operated upon with serum treatment, only 330 died, or 26.8 per cent. Timmer says that this diminution is not dependent upon a less virulent form of diphtheria, but the patients are operated upon in much better general condition. The fact that fewer cases occur that require operation he thinks is due to the more extensive use of antitoxin. He has also observed that the symptoms of stenosis disappear in many cases after serum injections, and thus an operation is avoided. Timmer notes that the mortality of diphtheria varies according to the age of the patient, the mortality being very high during the first two years of life. He found that the mortality fell during the period when antitoxin was used from 90 and 70 per cent. to 64.9 and 40.6 per cent, while in older children the fall was still greater, that is, from 55.2 per cent. to 26.8 per cent. Timmer includes in his article tables showing the mortality during the periods before and after the use of antitoxin in several hospitals that seems conclusive in showing the beneficial effects of the serum treatment of diphtheria.

Pantopon.—SAHLI (*Münch. med. Woch.*, 1910, lvii, 1326) says that pantopon has proved to be a most useful remedy after a long-continued trial. Pantopon is a derivative of opium, containing all the alkaloids freed from resins and other noxious substances. It is freely soluble in water, and so may be utilized for subcutaneous use. For subcutaneous use Sahli recommends a 2 per cent. solution of pantopon in 75 parts of water and 25 parts of glycerin. This solution remains stabile and

need not be sterilized before using. The ordinary dose of this solution is 1 c.c. The indications for its use are the same as for the other opium derivatives, but similar effects are obtained with correspondingly smaller doses. Sahli states that untoward effects such as vomiting, constipation, and excitability are much less frequent with pantopon than with morphine.

The Autolysis of Pneumococci and the Effect of the Injection of Autolyzed Pnumococci.—ROSENOW (*Jour. Amer. Med. Assoc.*, 1910, liv, 1943) states that pneumococci when suspended in sodium chloride solution disintegrate and become Gram-negative. This process has been proved to be a true autolysis and not due to the action of sodium chloride in the solution, or to the solubility of the protoplasm of the pneumococcus in water. He says that further studies of the soluble substances and the autolyzed pneumococci are in progress, but that the following preliminary statements can be made. It seems that by means of autolysis it is possible to separate, at least to a large degree, the toxic from the non-toxic or antigenic parts of the pneumococcus. The part which goes into solution is the toxic portion. It causes peritonitis and leukocytosis in animals; marked local reaction, leukocytosis, and some fever when injected subcutaneously in man. The opsonic curve shows only slight rise. It is impossible to immunize animals to any marked degree by repeated injections. Intravenous injections into rabbits may prove fatal. The injection of the non-toxic and, as it appears, the antigenic portion, the autolyzed pneumococci, on the other hand, causes practically no local reaction, only slight increase in the number of leukocytes, but a marked increase in the immunity curve as measured by the specific increase in pneumococco-opsonin. The usual negative phase is absent. From a number of tests it appears clear that the simultaneous injection of the toxic part interferes to a marked degree with the immunity curve produced by the non-toxic portion. The author tried the injection of autolyzed pneumococci in 25 patients with lobar pneumonia, and believes that it is a valuable aid in the treatment of this disease. In 2 cases of pneumococcic empyema, he also states, it seemed to have a decided beneficial effect, but more tests will be necessary to prove this point.

The Treatment of Gastric and Duodenal Ulcer.—SPRIGGS (*British Med. Jour.*, 1910, 2577, 1216) concludes from a comparison of his series of cases with a similar number of cases treated by other methods: (1) That the Lenhartz method of treatment is not more dangerous than treatment by nutrient and saline enemas, followed by a graduated milk diet. In these particular cases the recurrence of hemorrhage was less frequent and there were no deaths. (2) That the pain suffered by the patient in the course of treatment is less on the Lenhartz diet. (3) The diet gives far more nourishment than can be introduced into the body by nutrient enemas, and is, therefore, more desirable in patients who have frequently been for a long time in a state of semi-starvation, or have suffered a loss of blood or both. (4) That in cases treated by this method rectal injections may be entirely avoided. This is an advantage in a hospital, and a still greater advantage in treating cases at their homes, where rectal injections are not only regarded as extremely un-

pleasant, but are seldom efficiently administered. Gerhardt used the Leube and the Lenhartz methods, and obtained good results with each. This is also Sprigg's experience. The choice may then turn upon convenience, and there is no doubt that the latter method is more convenient. Whenever the Lenhartz method is discussed the objection is put forward that it does not seem wise to put food into the stomach immediately after a hemorrhage. The fact is that such patients do well, and recurrent hemorrhages are less frequent than in patients treated by other methods. Spriggs says that the treatment of duodenal ulcer should be the same as that for gastric ulcer. Patients with duodenal ulcer do well upon a Lenhartz diet. He often combines with it ½ ounce of olive or almond oil three times a day, following the method introduced by Cohnheim and by Walko, and advocated by Hertz. On this plan ½ ounce of oil is given every three hours and increased to 1 or 2 ounces. Nothing else is given except water for thirst, until there is no blood in the stools. Cream is then given and the foods of the Lenhartz diet are added gradually, but not the rice. The oil is now reduced to 1 ounce before each meal. He has tried this method thoroughly, and recommends it for patients who will endure it. To others it is exceedingly distasteful and fails on that account. Whenever retching or vomiting is caused the treatment should be altered. If the patient does not respond to one or other form of dietetic treatment, the possibility of the symptoms being due to gallstones must be carefully reconsidered.

Muscular Rheumatism.—SCHMIDT (*Med. Klinik*, 1910, vi, 131) believes that the pain of muscular rheumatism is neuralgic in character, and he suggests treating it with injections of physiological salt solution at the painful points. The injection of 5 or 10 c.c. of salt solution into the muscle at the most painful point will frequently relieve the pain, though, of course, it has no effect upon the cause of the pain. In protracted or very acute cases Schmidt advises lumbar puncture which may be followed by spinal anesthesia if necessary. Schmidt has seen lumbar puncture alone cure an obstinate case of myalgia and thinks that a trial is justified in the very severe cases.

The Treatment of Chorea with Large Doses of Arsenic.—HASSIN and HERSHFIELD (*Med. Record*, 1910, lxxviii, 15) say that arsenic in the form of Fowler's solution remains the most effective method of treatment of chorea, provided it is given in large doses. However, the possibilities of grave complications on the part of the gastrointestinal tract and nervous system renders this method of treatment inapplicable in many cases. Comby maintains that arsenous acid well diluted is much better borne than Fowler's solution. He takes 10 c.c. of a 1 to 1000 solution of arsenous acid, dilutes it with six tablespoonfuls of water and gives one tablespoonful of this mixture in milk every two hours. This is roughly equivalent to ⅛ of a grain of arsenous acid. Starting with this initial dose, he increases the amount of the arsenous acid solution by 5 c.c. each day until at the end of a week 40 c.c. are given. Then beginning with the eighth day, he progressively diminishes the daily dose by 5 c.c., so that at the end of the second week the dose is the same as the initial dose. Thus the entire treatment takes two weeks during which time the patient takes about six grains of arsenous acid. There

have been serious complications resulting from these huge doses of arsenic, and the authors made use of a modification of Comby's method as advocated by Filaloo. Filaloo, for a child of from four to six years of age, begins with a daily initial dose of 2 c.c. of a 1 to 1000 solution of arsenous acid, increasing the amount by 2 c.c. daily for seven days. He then diminishes the daily dose by 2 c.c., so that the entire course of treatment is over a period of two weeks. For older children the initial dose is 4 c.c., which is increased daily by 4 c.c., and after a week is diminished by the same amount. Hassin and Hershfield report excellent results with the use of this method and claim that large doses of arsenic are much better borne by this method than when Fowler's solution is used. They also think that the bye-effects of arsenical treatment can be greatly mitigated by using arsenous acid instead of Fowler's solution.

The Treatment of the Hookworm Disease.—LINDEMAN (*Jour. Amer. Med. Assoc.*, 1910, liv, 1765) gives the following treatment for hookworm disease: The patient should have nothing to eat from noon of the day previous to the administration day of the thymol. On this day and the day following, fat of any kind, milk, cream, butter, bacon, etc., should be avoided. Whiskey, beer, wine, and oils are absolutely interdicted, as all these can dissolve thymol. Early in the evening of the first day sufficient Epsom salts should be given for efficient purgation. It is important that the bowels should be well moved. Early the next day the dose of thymol decided on should be divided into two parts and given one hour apart. It is best administered in cachets triturated with equal parts of milk-sugar, and before using, the cachets should be well softened in water until they are of the consistency of a raw oyster. It is best to put the patient to bed, on the right side. The thymol should be retained for from two to five hours, unless distress or symptoms of intoxication occur. Epsom salts should then be used for flushing the bowels and expelling the drug. The following dosage as outlined by the State Board of Health of Florida is considered safe to use: Under five years of age, up to 8 grains; from five to ten years of age, 8 to 15 grains; from ten to fifteen years of age, 15 to 30 grains; from fifteen to twenty years of age, 30 to 45 grains; from twenty to sixty years of age, 45 to 60 grains; over sixty years of age, 45 grains. In determining the size of the dose the apparent age and the real weight of the child should be considered. The nauseating effects of Epsom salt can be considerably lessened if dissolved in the smallest quantity of warm water possible and swallowed; this to be then followed by a large quantity of any mild fluid, even water. The mixing thus takes place in the stomach instead of in the glass. The patient may begin to eat after the bowels are well moved on this day. It is best that they should eat sparingly and avoid distress from engorgement. The same precautions should be observed on this day regarding fats, oils, alcohol, etc. Once the worm is eradicated, fresh air, sunshine, plenty of water, and proper food are the chief requirements for the treatment of the anemia of hookworm disease. Iron, arsenic, tonics, and ferruginous vegetables are indicated. The patient should be treated at intervals of one, two or three weeks until the stool is free from eggs or parasites. The more debilitated patients should be treated at longer intervals. Betanaphthol

is not so toxic to the parasite as thymol, but has a more toxic action on the kidneys. The anthelmintic properties of turpentine are less than those of thymol; besides turpentine is less desirable because of its ready absorption and liability to produce acute nephritis. Pressed thymol tablets should never be used.

PEDIATRICS.

UNDER THE CHARGE OF
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OF PHILADELPHIA.

Effect on a Syphilitic Child of Injecting the Mother with Ehrlich's "606."—KARL TAEGE (*Münch. med. Woch.*, 1910, lvii, 1725) reports a remarkable recovery from congenital syphilis by injecting the mother with Ehrlich's arsenical compound (dioxy-diamido-arseno-benzol). A woman pregnant at term exhibited mucous patches, condylomas, and many spirochetes. The child when born was extremely pale, weak, and sickly. It did not cry, but lay in an apathetic state and took the breast poorly. No characteristic signs of syphilis appeared until the eighth day, when numerous lesions of pemphigus appeared on the soles of the feet and at the same time syphilitic paronychia on both hands. These lesions tending to spread, the mother was injected in each buttock with 0.3 gram of Ehrlich's "606" in sterile water. On the third day the woman complained of pain, on the fourth day a reddish exanthem appeared on the buttocks, and on the fifth day headache developed. Three days after the injection the lesions began to fade rapidly and the spirochetes disappeared. The child showed increased spread of the lesions for two days following the mother's treatment. The third day it showed rapid clearing up of the symptoms, and by the fifth day the pemphigus and the paronychia had disappeared, the grayish pallor had given place to a healthy tint, the child was no longer apathetic, but cried lustily and took the breast greedily. Ten days later the child was well and still free from symptoms. An explanation of the production of this remarkable result is difficult to find. That the "606" compound was not transmitted to the child through the mother's milk was shown by the fact that this milk contained no trace of the arsenic. Ehrlich himself explains it by the theory that the sudden destruction of the spirochetes sets free a large amount of endotoxins which excite the production of antitoxins, and these latter are then transmitted through the mother's milk to the child with curative effect. However this may be, the sudden clearing up of the symptoms in the child did follow the use of the "606" on the mother, and this result may offer a new and improved method for treating syphilitic infants. Ehrlich especially warns against injecting his remedy directly into small infants, not from any toxic quality in the remedy itself but from the large amount of endotoxin liberated in the child's system from the destruction of the many spirochetes.

Venereal Disease in Children.—C. F. MARSHALL (*Brit. Jour. Child. Diseases*, 1910, vii, 385) discusses syphilis and gonorrhœa as seen in infants and children. Acquired syphilis is the form here considered, as simple chancre is exceedingly rare. Acquired syphilis exhibits a chancre which is small and usually situated on the face. An infant may be infected by wet nurses, kissing, playing with congenitally syphilitic children, and by contaminated spoons, nursing bottles, etc. The absence of characteristic congenital lesions and the contrast between the age of the child and the quality of the lesions will aid in differentiating acquired from congenital syphilis. Tertiary lesions are often impossible to distinguish, and the older the child the more difficult becomes the differentiation. Diagnosis is often important from a medicolegal standpoint. The relation of syphilis to tuberculosis is important. Fournier points out that syphilis predisposes to tuberculosis, especially the pulmonary type. A symbiosis of syphilis and tubercle may occur, usually in congenital syphilitics, which probably accounts for many of the glandular, chronic bone and joint affections formerly designated struma or scrofula. These conditions improve materially on mercurial treatment, especially the latter, and should be tested both by the Wassermann and the tuberculin methods. Gonorrhœa in female children appears usually as a vulvovaginitis, and occurs occasionally as an epidemic in schools and institutions for girls, the disease spreading from some infected person, or from towels, etc. In boys the disease takes the form of a urethritis, but may involve the nose and mouth. However contracted, this disease in children may take the same complications as occur in adults. Gonococcic arthritis and septicemia occur in both sexes. Kimball reports 8 cases of gonorrhœal pyemia in infants under three months old, exhibiting arthritis in 6 cases; 3 cases had gonorrhœal stomatitis. Northrup, Lucas, and Pollack report many cases of arthritis and peritonitis in children following gonorrhœal infection. Gonococcal septicemia may simulate closely enteric fever, but usually shows joint symptoms. The gonococcus is often found in the blood and in 50 per cent. of cases in the fluid from involved joints. The subacute form often simulates tuberculous joint conditions. Syphilitic joint affections, however, usually exhibit little pain and discomfort. Eyre, Butler, Whitehouse, and others found vaccine treatment in acute and chronic gonorrhœa better than the routine treatment. Besides local treatment with silver salts, etc., a preparation of lactic acid bacilli and also yeast in asparagin or cane sugar as a medium have proved of considerable value.

Intra-uterine Transmission of Malaria.—W. PIES (*Monatsschrift f. Kinderheilkunde*, 1910, ix, 51) states that reported cases of intra-uterine transmission of malaria are few, even in malarial districts. But even before the discovery of the plasmodium of malaria it was found that both premature and full term infants whose mothers suffered from malaria were born with the characteristic signs of malarial cachexia. Numbers of cases are reported by Monti, Playfair, and others, in which children at birth presented undoubted evidences of malaria. Moncorvo, in Rio de Janeiro, out of 5000 cases of malaria in children, reported 20 undoubted clinical cases of malaria in the newborn, although the plasmodium was not found in the placenta or fœtal blood. Bal-

lantyne found the plasmodium in the blood of a mother and child suffering from intermittent fever on the first day of the puerperium. Holt reports a case in which the mother suffered from tertian malaria ten days before her confinement. Eighteen hours after the birth of the child it exhibited chilliness followed by a fever and perspiration, which was repeated on the following day, when a blood examination showed the malarial parasite in the child and the mother. Pies himself, reports the case of a child born in Germany, in January, 1910. The mother had an attack of malaria in May and August, 1909, which she contracted in Africa. When seven months pregnant, the mother suffered severe uterine pains, which subsided on rest in bed. Birth was normal and the child healthy until the thirtieth day, when it developed a yellowish pallor. Two days later it exhibited fever followed by profuse perspiration and a fall in temperature. This attack was repeated the following day, and an examination showed anemia and enlarged spleen and liver. The blood of the child taken during the paroxysm showed many tertian parasites, schizomycetes, and gametes, with characteristic changes in the red blood cells. The malarial attacks continued for six days, when they disappeared quickly under small doses of quinine. Professor Koch, who studied the case, concluded from the blood picture that it could not have been a fresh infection. The mother showed no plasmodia, having previously been under quinine treatment. A number of authors claim that malaria cannot be transmitted to the child in utero by way of the placenta. Pies believes the malarial infection is carried direct to the child through the blood current (Gärtner and Sitzenfrey have shown the possibility of placental infection by tuberculosis). Pies believes that uterine contractions caused breaking of the villi, and this allowed the mother's blood to get directly into the circulation of the fœtus. He explains the length of time before the paroxysms appeared by a long incubation period, as proved by Koch, Simms, and Warwick. The child was born in a community free from malaria and mosquitoes, and primary infection can be excluded. He believes this to be a case of intra-uterine transmission of malaria by a direct blood stream.

Hypothyroidism in Children.—W. STOELTZNER (*Jahrbuch f. Kinderheilkunde*, 1910, xxii, 149) deprecates the general unfamiliarity with infantile myxœdema, especially the rudimentary forms, which are often difficult of diagnosis and often overlooked, since the usual signs of myxœdema are slight. The frequency of the rudimentary form he places not far behind that of the fully developed infantile myxœdema. In a boy, aged six years, the only symptoms were a cessation of body growth dating from his second year, and a cast of feature which gave only a suggestion of the cretinoid. He was fairly bright mentally and attended school. On treatment with thyroid extract, the results were brilliant. Body growth recommenced and proceeded rapidly, and the entire physical and mental condition improved wonderfully, the features losing their cretinoid suggestion. The etiology of the thyroid changes behind this condition is obscure, but Stoeltzner reports two cases in which hypothyroidism began with an infectious disease. In one case a girl, aged two and one-half years, stopped growing during

a severe attack of measles, and developed large myxœdematous infiltrations beneath the skin, accompanied by mental dulness. In another case a girl, aged five years, during an attack of mumps, developed an acute enlargement of the thyroid gland, which disappeared in a short time. Immediately following this the body growth ceased, the hair became coarse and lusterless, and mental dulness developed. Thyroid extract was exhibited for a short time until the patient passed from observation. Five years later the child was found to be normal in every way and showed no signs of the disease. The mother stated that the child had remained in the myxœdematous state for two years after the first treatment, and had then suddenly begun to improve naturally and without medication. Stoeltzner can find no cases of traumatic hypothyroidism in literature, but himself reports a circumstantial case in a girl, aged nine years, with fully developed myxœdema, which had followed immediately on a deep lacerating wound of the neck directly over the site of the thyroid gland, occurring two years before. A deep scar an inch long marked the site of the wound. Small doses of thyroid gave marked improvement. Stoeltzner believes that the condition in children which is marked by excessive fatness, flabbiness, turgidity, and pallor, with enlarged tonsils and adenoids, and a dull phlegmatic mentality, is identical with hypothyroidism. In a child exhibiting this condition with rickets, thyroid extract cleared up the former condition nicely, but did not affect the latter. He believes good results will follow the use of thyroid extract in children with the above diathesis. He suggests the examination of such cases by the *x*-rays to determine whether a condition of bone development characteristic of hypothyroidism may not also be present.

OBSTETRICS.

UNDER THE CHARGE OF

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The Significance of Albuminoid Bodies in the Urine of Pregnant and Puerperal Women.—Jageroos (*Archiv f. Gyn.*, xci, Heft 1, 1910) has made a thorough study of the significance of albuminoid bodies in the urine of pregnant and puerperal patients. He reviews the literature of the subject, and from his own studies and the review of the literature concludes that albuminuria is a normal phenomenon in pregnancy and in the puerperal period. The term "normal albuminuria" should be restricted to minute quantities of albumin found in perfectly healthy patients when the organism is in a condition of complete equilibrium. Albuminuria occurring during labor is a reasonable accompaniment of parturition; the quantity is greater than can be considered normal, and is often the greatest seen in any except a permanent pathological condition. The condition requires no especial and separate treatment, and

cannot be considered a permanent pathological lesion. The albuminuria of labor is differentiated from the other by the presence of labor and by the fact that it ceases after parturition. The more abundant the albumin the more gradual is its disappearance. The albuminuria of the puerperal period is the continuation of that of labor, and is never a separate condition. The albuminuria of labor is most pronounced toward the end of parturition, especially in cases of difficult or complicated labor. Circumstances which do not tend to make parturition especially difficult have no influence upon its albuminuria. The sediment of urine taken during labor shows organized material, including cylindroids, so often seen in cases of abundant albuminuria. These cylindroids are not abundant and are to be distinguished from others by the fact that they contain superficial kidney epithelium in abundance, but not the elements which come from the deeper kidney structures. In the normal puerperal period the sediment gradually and completely disappears. The passage of urine during labor is usually within the normal average limit, increasing after the delivery of the fœtus, then growing less some hours later, and during the first days after delivery does not reach the average quantity. The specific gravity of the urine after labor is not, as a rule, abnormal; the quantity of albumin does not vary from that of blood serum or of the urine obtained after simple congestion of the kidneys. Increased quantities are sometimes observed after labor and seem to be connected with the congestive condition of the kidneys already described. The rapid disappearance of cylindroids and albuminuria after labor proceeds of itself without any essential alteration in the kidney. It is fair to conclude that an uncomplicated labor following an average normal pregnancy cannot produce definite disease of the kidneys. In some cases among the albuminoid bodies found in the urine of parturient patients there is found a certain albuminoid substance reacting to acetic acid. Its degree of solubility does not seem to be influenced by the condition of the kidneys. In normal circumstances albuminose is not found in the urine of parturient and puerperal patients, nor can there be detected a puerperal peptonuria. The probable causes of the albuminuria seen at labor are violent muscular exercise, cooling of the surface of the body, excitement of the central nervous system, venous stasis, toxins produced by the fœtus, wounds of the genital tract during labor, which often affect the urethra and bladder. These causes produce their result by mechanical and chemical means. Under the first class are disturbances of the circulation, greatly increasing arterial tension and traumatism, followed by mild auto-intoxication. It can well be understood that in a patient having kidneys already diseased or with a predisposition to nephritis, pregnancy and labor might result in permanent damage to the kidneys.

The Absorption of Bone by the Uterus.—KOEBNER (*Archiv f. Gyn.*, 1910, xci, Heft 1) has conducted at the Laboratory of Fraenkel, in Breslau, investigations to determine the question as to the possibility of absorption of fœtal bone in the uterus. He concludes from his experiments that it is perfectly possible for bony material to be absorbed within the uterus. The inspection of fœtal bones shows that in three cases fœtal absorption could be detected, with also that of bony material. Cicatricial tissue was observed in the corpus luteum on the nineteenth

day of pregnancy, and the question arises whether this had any influence upon the condition of bony tisuse in the embryo or fœtus. It is not difficult to understand that bony material and especially calcium can be absorbed in the body. In osteomalacia and rickets this occurs constantly. In the growth of the skeleton in various diseased processes the same thing happens.

Transplantation of Ovaries.—HIGUCHI (*Archiv f. Gyn.*, 1910, xci, Heft 1) has conducted experiments upon this subject, and reviews the literature already in existence. He concludes that the autoplastic transplanted ovary heals in its new location, and although it undergoes some alterations, especially diminution in size, was able to perform its functions a year after the operation. The mucosa and glands of the uterus became hyperlastic. The muscular tissue at the mesometrium is of normal thickness and is smaller upon the free side. The mucous membranes of the Fallopian tubes and the vagina are also hyperplastic, but not to the same degree as that of the cornua of the uterus. An ovary transplanted from one animal to another of the same species becomes greatly altered, losing its typical appearance, and undergoes marked atrophy or disappears. The mucous membranes and glands of the uterine cornua and cervix are markedly atrophied. In the muscular cells the uterine glands and papillæ and in the connective tissue atrophy is especially marked, and this process gradually extends to the cervix, Fallopian tubes, and vagina. Human ovaries transplanted become entirely absorbed.

Labor after Extraperitoneal Cesarean Section.—LICHTENSTEIN (*Zentralb. f. Gyn.*, 1910, No. 26) reports from Zweifel's Clinic in Leipsic two cases of labor in patients previously delivered by extraperitoneal section. Case I had a flat rachitic pelvis, and had had the ordinary Cesarean section in 1904 and the cervical extraperitoneal section in 1908. The child seemed large and vigorous, in the first position, vertex presentation. The head was movable about the entrance to the pelvis. After pains had continued during the night, operation was performed during the morning following. The os was then the size of a half dollar, the membranes unruptured, and the fascia was easily opened without opening the peritoneum. The recti muscles were pushed aside and the peritoneum separated from the bladder and anterior portion of the cervix and stitched to the abdominal wall, closing off the peritoneal cavity. A longitudinal incision was then made in the cervix, the membranes ruptured, and the child delivered with forceps. The placenta was expressed, the wound of the cervix was closed with catgut, and the fascia wound with continuous catgut stitches. The peritoneum was brought down and stitched to its original situation at the base of the bladder, and the abdomen closed. This was the first extraperitoneal section performed upon the patient, in which she made a good recovery. About a year afterward she again returned to the Clinic, pregnant, and soon after came into labor. The patient complained of pain in the scars of the previous operations. The head was movable above the pelvic brim. The patient requested that the possibility of conception in the future be prevented. Accordingly abdominal section was practised, and the anterior wall of the uterus found adhesive to the abdom-

inal wall. The adhesions were separated, the uterus opened, and the child delivered. The cord was wrapped firmly about the neck and the child was deeply asphyxiated, but revived. The placenta was removed, the uterus sutured, and sterilization was performed by excision of the tubes. Inspection of the tissues showed no abnormality as the result of the previous cervical operation. There was no thinning of the uterine wall, and by palpation the scar could not be found. The patient made a good recovery. Case II had had an extraperitoneal cervical section, with transverse incision above the pubes. The operation had been successful and the patient recovered without incident. During the subsequent pregnancy the patient was in remarkably good health and complained of no distress as the result of the first operation. In the second pregnancy polyhydramnios and twins were diagnosticated. When the patient came into labor, twin pregnancy was present. It was found that the first child could not descend, as the children seemed to become blocked at the entrance of the pelvis. Version was then performed and the first twin extracted. The membranes of the second were then ruptured, and it was delivered by version. The first twin survived, the second was stillborn with anasarca and acites. The mother made a good recovery. Lichenstein also quotes 8 cases collected by Hartmann and 1 by Scheffzek, in which extraperitoneal section had been repeated. The birth had occurred one or more years after an original operation. In these operations the patient was left in good condition afterward and the tissues in practically normal condition

GYNECOLOGY.

UNDER THE CHARGE OF

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Abdominal Total Extirpation of the Uterus, Ventrofixation of the Vaginal Fornix; Procedures in Extensive Prolapsus.—O. KUSTNER (*Monatsschrift f. Geburts. und Gynäk.*, 1910, xxxii, 1) is not satisfied with his results in such cases when treated by vaginal hysterectomy combined with anterior and posterior colporrhaphy. Prolapse of the anterior vaginal wall and cystocele constitute the prominent features of a recurrence. The following procedure has given him good results. Longitudinal hypogastric incision, with extirpation of the uterus and adnexa. The vaginal cuff is closed transversely and covered by peritoneum, the median peritoneal sutures also passing through the vaginal wall. The vaginal stump is then fixed to the lower angle of the incision by means of 6 to 8 silkworm-gut sutures which include peritoneum, subperitoneal tissue, and fascia. In closing the abdominal wound, the suture at the lower angle also picks up the vaginal stump. If the patient's condition permits, posterior colporrhaphy is performed.

Gonorrheal Salpingitis: A Histological Study.—F. B. GURD (*Jour. Med. Research*, 1910, xxiii, 151.) According to AMERSBACH, a positive diagnosis of gonorrhœal salpingitis can be made in those cases presenting infiltration of the thickened folds of mucosa with plasma cells, lymphoblasts, and lymphocytes, in which the cellular infiltration in the wall is made up principally of plasma and lymphoid cells and in which the free pus contains a considerable percentage of lymphoid cells, lymphoblasts, and plasma cells. The author has carefully studied twenty cases of salpingitis, and finds that eighty per cent. were probably of gonorrhœal origin. With proper care and technique, the gonococcus can be cultivated in a large percentage of cases, even in old lesions—35 per cent. in his series. Old pus collections may become the nidus for infection by other organisms, such as the colon bacillus. This organism in all probability enters the already present pyosalpinx by direct passage through the tissue from the frequently adherent sigmoid. The appearance of the tubes examined in the series suggests that the exacerbation of symptoms which occurs periodically in cases of chronic salpingitis, is due to the repeated involvement of the peritoneal covering in an acute inflammatory process. Although it is apparently impossible to speak definitely of the distinctive histological picture of gonorrhœal salpingitis, the great preponderance of plasma cells over the other inflammatory cells, as well as the localization of the lesion chiefly in the mucosa and submucosa, are strongly suggestive of the gonorrhœal origin of an affection. The gonococcus invades the tube by means of continuity of surface, and the histological picture is probably to a great extent dependent upon this fact.

The Involution of the Corpus Luteum.—MILLER (*Archiv f. Gynäk.*, 1910, cxc, 263), as the result of his examinations, concludes that the fresh corpus luteum contains no neutral fat; only after the beginning of involution can fat be demonstrated in the lutein cells. Fatty degeneration in the corpus luteum of pregnancy occurs only during the puerperium. The menstrual corpus albicans is due solely to hyaline hypertrophy of the connective-tissue reticulum, with disintegration of the lutein cells which have undergone fatty degeneration. Simple necrosis predominates over fatty degeneration in the retrogression of the corpus luteum of pregnancy. The corpus luteum is penetrated by numerous processes of connective tissue, which later undergo hyaline degeneration. In the second half of pregnancy, or even earlier, the majority of cases show colloid degeneration of the lutein cells, which proves their epithelial rather than connective-tissue origin, since colloid is the product only of epithelial cells. The menstrual corpus luteum usually shows no colloid, or, if present, only as minute, widely scattered drops. Toward the end of pregnancy and during the puerperium the corpus luteum practically always contains lime salts, which are never present in the menstrual corpus luteum. Therefore, the presence of lime salts or considerable colloid is diagnostic of the corpus luteum of pregnancy. One should not confuse true lutein cells with cells containing fat granules, which result from a chronic inflammation, as the author has observed in the ovary, tube, uterus, omentum, and appendix.

Retroversioflexio Uteri.—During the past ten years 304 cases have been operated upon in the Schauta clinic for retrodeviation of the uterus. Vaginal operations were employed in 228 cases, abdominal in 73, and the Alexander-Adams in 3. ADLER (*Monatssch f. Geburts. u. Gynäk.*, 1910, xxxii, 298) gives in detail the end results of 182 cases, the interval since operation varying from one to ten years, with the exception of five cases of eleven months duration. Uncomplicated retroversion often presents no symptoms, or the patient may complain of sacral backache, dragging sensation, a feeling of pressure in the rectum, and, less frequently, bladder disturbances; the chances of conception are probably lessened. An analysis of his cases gives conclusive evidence that menorrhagia and metrorrhagia are due, not to the malposition of the uterus, but to associated complications, such as metritis, myomas, disease of the adnexa, etc. Treatment is instituted only in the presence of symptoms which can be attributed to the backward displacement. If the uterus is freely movable, it is replaced and held in position temporarily by a pessary. Should the symptoms be relieved and the uterus fail to remain in good position after removal of the pessary, operation is advised. He is strongly opposed to the prolonged use of the pessary. Operation is employed in cases of adherent retrodeviation only after conservative measures have failed. For movable, uncomplicated displacements, the author prefers vaginal fixation of the round ligaments in the region of the urethra, an operation not yet published. Doleris' (Gilliam) operation, which has given ideal results in 33 cases, is employed when the uterus is adherent, when a movable displacement is accompanied by disease of the adnexa or appendix, and in virgins.

A Deceptive Form of Appendicitis in Women.—CROSSEN (*Surgery, Gynecology, and Obstetrics*, 1910, xi, 196) reports two unusual cases of appendicitis the recognition of which is important from the standpoint of both diagnosis and treatment. Cinically, both cases ran an extremely chronic course, with comparatively mild inflammatory symptoms. The pelvic examination revealed a flattened, firm, somewhat tender, and fairly movable mass in the right ovarian region. At operation the cecum occupied the right side of the pelvis and was held down by a few frail adhesions. After freeing the adhesions, the freely movable cecum revealed what appeared to be an intracecal mass, occupying its inner aspect and extending to the ileocecal junction. The mass could easily have been mistaken for carcinoma or tuberculosis. The true condition of affairs was explained, however, by finding a chronically inflamed, retrocecal appendix completely buried between the adherent folds of a greatly thickened cecal wall. The appendix was removed and both patients made a complete recovery, although absorption of the infiltration in the cecum required five months in one case and nearly a year in the other.

The Operability of Recurrence Following Radical Operation for Carcinoma of the Uterus.—HOEHNE (*Monatssch f. Geburt. u. Gynäk.*, 1910, xxxii, 161) shares the view of von Rosthorn and Franz, that in selected cases recurrence should be removed by operation. Should the recur-

rence be of the diffuse, infiltrating type, operative intervention is useless; when the carcinoma presents itself as a more or less circumscribed nodule, especially when situated in the region of the scar of the primary operation, excision is advisable. Two cases are cited illustrating the value of this procedure. He urges the importance of a routine examination following radical operation. The patient is instructed to return at a definite time, and if the examination reveals a suspicious swelling, she is kept under close observation for two weeks. Should the mass enlarge, it is in all probability carcinomatous, and requires operation; with no enlargement, the patient is discharged and re-examined at regular intervals. By following this plan, the author is convinced that the number of permanent cures will be considerably increased.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF
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Laryngeal Stenosis as a Frequent Result of Operation Involving the Hyoid Bone.—MOURE (*Annales des mal. de l'oreille, du larynx, du nez, et du pharynx*, June, 1910), having had occasion to practise a number of operations involving transhyoidal section, was able to watch a certain number of cases for some time after operation, and in every one of them he found, as a result of the operation, a laryngeal stenosis due to antero-posterior elongation of the glottis, which during inspiration took the form of an ellipse instead of the isosceles triangle. As a result of this abnormal condition the arytenoids are unable to separate in the middle line, the vocal cords remain in juxtaposition, or at least so little separated from each other during inspiration that respiration is found greatly compromised. The laryngoscopic image is that of paralysis of both dilators of the glottis, with this difference, however, that the orifice is changed in form.

A Safe Intranasal Method of Opening the Frontal Sinus.—THOMSON (*Laryngoscope*, August, 1910) combines the best features of the methods of Ingals and of Goode into what he believes to be a perfectly safe as well as a simple operation. The anterior end of the middle turbinate is removed and a probe passed into the frontal sinus. A pointed rasp similar to Goode's but grooved on its back is guided as far as it can be pushed by reasonable pressure, and then withdrawn, cutting away the bone downward and forward, leaving room for any instruments that may be required for the removal or destruction of tissue. Healing is said to occur quickly, with immediate relief to the severe headaches attendant on suppuration of the frontal sinus.

Fracture of the Thyroid Cartilage.—MATTHEWS (*Jour. Amer. Med. Assoc.*, September 10, 1910) reports a case in an insane man, aged forty-nine years, who had been forcibly struck over the larynx by a fellow inmate. Examination disclosed complete fracture of the thyroid in the median line. Immobilization was secured by compresses on each side, held in place with adhesive strips. Food was prohibited for twenty-four hours. Hoarseness continued for four days, when rapid improvement ensued. The fixation strips were removed on the seventh day and a perfect union was found. On the ninth day the patient was up and about as usual.

Postoperative Acute Meningitis in Frontal Ethmoidal Sinusitis.—JACQUES (*Annales des mal. de l'oreille, du lar., du nez, et du pharynx*, June, 1910), having observed two cases of this complication, with death in forty-eight hours after operation, found the whole subarachnoid space invaded with pathogenic germs, streptococci and pneumococci. He therefore counsels that if operation appears necessary during the course of the painful exacerbation of the disease, the operative intervention should be limited to simple trepanation of the frontal sinus in the neighborhood of its floor, without decortication, and followed by external drainage. He also believes it would be prudent in operating upon chronic ethmoidal sinusitis to respect, as much as possible, the upper turbinate, the region of the cribriform plate, and the olfactive portion of the septum in the region of the cribriform plate.

Enchondroma of the Larynx.—MOURE (*Revue hebd. de laryngologie et d'otologie*, August, 20, 1910) reports a case of very large lobated enchondroma of the upper portion of the larynx, attached to the left arytenoepiglottic fold and the left wing of the thyroid cartilage. Preliminary tracheotomy was performed. Three weeks later the removal of the growth was undertaken by external access under local anesthesia. The growth was so large that it had to be removed piece-meal, and some of the pieces, being too voluminous to be removed through the thyroidal incision, had to be pushed into the mouth, whence they were expectorated. After some tribulation the patient made a good recovery, but it was some time before he could be relieved of the tracheal cannula.

Chondroid Fibroma of the Subglottic Region of the Trachea.—MOURE (*Revue hebd. de laryngologie et d'otologie*, August 20, 1910) reports a case of an extensive growth of the trachea, of which large portions were removed by external access after incision, under local anesthesia, of the upper five rings of the trachea. Although immediate relief followed the operation, and the patient respired freely, unfortunate complications set in and the patient succumbed by suffocation at the end of a week. At the autopsy extensive stenosis of the trachea was revealed, due to unremoved and unremovable but unsuspected continuations of the growth. The cricoid cartilage was completely degenerated, crumbling at the slightest contact, and was totally deformed.

Simplification of the Radical Operation for the Cure of Maxillary Sinusitis.—MOUNIER (*Jour. Laryng.*, August, 1910) operates at one sitting without subsequent dressings. He does not resect any part of the inferior

turbinate body, and he makes a very small sinuso-nasal opening with his special cutting forceps. Traumatism is said to be reduced to a minimum, and the patient to be laid up for a very few days only.

Sepsis following Tonsil Operations.—DEAN (*Larnygoscope*, July, 1910) contributes an elaborate article upon sepsis following operations on the tonsils, and reports a case of death from sepsis, a case of cerebral thrombo-sinusitis, and a case of gangrene of the muscles of the neck, following tonsillectomy.

Complications of Adenectomy.—As immediate mishaps, PARREL (*Jour. Laryn.*, August, 1910) mentions burns, and breakage of instruments; and as remote complications, synechiæ, adenitis, latero-retro-pharyngeal inflammations, pulmonary abscesses, and lastly, generalized septicemia. To avoid these he advises the operation in Rose's position, under chloride of ethyl, abstinence from hurry, attention to asepsis, and a strictly surgical technique.

Submucous Turbinotomy.—In the numerous cases in which enlargement of the turbinate body is due to the magnitude or to the unusual shape of the bone, ZARNIKO (*Jour. Laryn.*, August, 1910) recommends submucous resection of the turbinal bone instead of the undesirable removal of the entire structure. He has performed over thirty such operations during the last two years, making careful selection of his cases, and is well satisfied with his results. He considers it as a necessary adjunct to many submucous resections of the septum.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Parasitic Culture.—DAWSON (*Popular Science Monthly*, September, 1910) discusses this subject in an interesting and unique way. In fact, he opens up questions of the greatest importance in both physical and mental development. Starting out with the generally admitted fact that functionless organs are harmful to the body as a whole, he develops the thesis that overtrained organs, whether muscle or nerve, are also harmful. He holds that the athelete is none the stronger on account of the unusual development of his muscular system. On this point he makes the following statement: "It has been observed by physicians that very frequently athletic types of manhood have weak hearts, weak lungs, and weak vital organs generally. Often their health and efficiency in later life are poor; and in not a few cases they break down prematurely. These observations have set both medical men and teachers of physical culture to thinking, and we are now being told that there is danger of overdeveloping the muscular

system; that overdeveloped muscles impose a severe strain upon the rest of the organism; and that all muscular development, unless it is utilized, becomes a tax upon bodily energy, and may give rise to disease. Only very recently a naval officer, who was an athlete while in the Naval Academy, is reported as having failed to meet the required tests of physical efficiency; and his physician ascribes his failure to his earlier muscular development in excess of the needs of his later life. That is to say, "his vitality was reduced through parasitic muscular culture." He also quotes with approval the following from Payot's recent work on the *Education of the Will:* "The qualities of vital resistance are in no way dependent upon muscular strength. A man may be an athlete in a circus, or able to do the heaviest porter's work, and yet have very poor health, while another man who lives in his study may have an iron constitution with mediocre muscular power. Not only have we no reason to aspire to athletic strength, but rather we ought to avoid it; because it can only be developed by violent exercise, and such exercises not only interfere with the regularity of the respiration, and cause very distinct congestion in the veins of the neck and brow, but they are undoubtedly weakening and exhausting. We have come to the conclusion, therefore, that it is not England with her violent system of exercise which we ought to imitate in this connection, but rather Sweden, who has completely given up such ruinous physical efforts for young people in her schools. There the object is to make young people strong and healthy, and they have perceived that excessive physical exercises are more sure to lead to a breakdown than excessive study." In like manner, Dawson holds that the excessive time and effort given to mathematics and the classics overdevelop certain neurons which are but little used in after life, but which must be maintained at the expense of the organism. This interesting article is summarized by its author as follows: (1) It is a law of the biological world that unused organs become parasitic upon the life, draining off the energy of the individual and tending to become diseased. (2) It has been found that physical culture, which leads to the hypertrophy of special muscles, entails a drain upon the general vitality. As in life in general, so in physical education, organs that can perform no adequate function are wasteful of human energy. (3) Experimental psychology is showing that the culture of particular intellectual organs and functions cannot be transformed to other organs and functions, except where there are elements in common. Histology and pathology of the nervous system confirm the conclusions of psychology in this respect. (4) Intellectual culture, not being transferable, must become parasitic and a cause of mental disorganization when it fails of application and usefulness in the life of the individual. Illustrations are to be found in the over-refinements of culture in academic communities, in the nervous instability frequently met with among educated men and women, and in the religious and social vagaries and perversions that crop out in the older and more highly cultivated centres of population. (5) The artificial culture of the secondary schools and colleges in our democratic society, in proportion as it is diffused through larger sections of our population, is likely to develop a cultured proletariat, ill-balanced and inefficient as individuals and a source of danger in our civilization."

The Presence of Negri Bodies in the Saliva.—GANSLMAYER (*Centrbl. f. Bakteriologie*, 1910, lv, 487) inoculated guinea-pigs and rabbits with forty samples of the submaxillary saliva of rabid dogs, and in thirty-seven of these experiments rabies resulted. In none of these samples of saliva, also in none of twenty samples of parotid saliva, could Negri bodies be detected by the application of the staining methods ordinarily employed in searching for them in nerve tissue.

The Tropical Sunlight.—FREER (*Philippine Jour. Sci.*, 1910, v, 1) reports upon the work now in progress in the Bureau of Science on the effects of sunlight in Manila. Much has been written on the subject within recent years, but the problem is a complicated one, and hasty conclusions may be rendered if all factors are not given due consideration. Some years ago it was generally held that the solar spectrum is divisible into three classes of rays. Those of the blue, violet, and ultraviolet regions are designated as actinic and cause chemical changes in the substances upon which they fall. Those in the visible field cause light, while the ultrared produce heat. However, it was shown by Bunsen and Roscoe, as long ago as 1859, that there is no sharp line of demarcation between these sets. One man's vision may take in much more on either side or on both sides than the other, and chemical changes and elevation of temperature are not wholly wanting in the field of vision. Still, three divisions roughly hold good. The intensity of the actinic rays has been studied by their effects upon carbolic acid and aniline, oxalic acid, and other chemical bodies. The coloration of phenol by exposure to sunlight is due to oxidation, and the presence of moisture is not necessary. "Crystals of such pure, dry phenol, when sealed in a tube with pure, dry oxygen and placed in the sunlight in Manila, at a temperature of approximately 30°, color perceptibly after two hours, and the entire mass changes to a deep red liquid after five days." When pure aniline is sealed in a thin glass tube and exposed to the direct sunlight, it darkens and assumes a red shade in less than ten minutes. Methyl alcohol is speedily converted into formaldehyde, and methyl salicylate is decomposed, and the alcohol formed is changed into formaldehyde. These reactions show that tropical sunlight induces chemical changes which either do not take place at all or proceed very slowly in temperate climates. Whether the intensity of the actinic rays is the specially harmful factor in the effect of tropical sunlight on the white man, or not, remains to be determined.

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